FINDING OF NO SIGNIFICANT IMPACT (FONSI)

FIRE MANAGEMENT PLAN 2004

ISLE ROYALE NATIONAL PARK

Background

Isle Royale National Park (Isle Royale) is a forested archipelago surrounded by the deep, cold waters of the largest of the Great Lakes. The park is located in the northwestern section of Lake Superior. It consists of the main island – Isle Royale itself, which is 45 miles long and up to nine miles wide – and about 400 smaller islands. Its boundary extends 4.5 miles into Lake Superior, except where the nearby U.S.-Canadian border comes closer. The national park's total area is 571,796 acres, divided between 133,788 acres of land, and 438,008 acres of surrounding Lake Superior waters. Approximately 200 inland lakes and ponds are scattered across Isle Royale, as are numerous bogs and marshes. Isle Royale is primarily a North Woods wilderness and maritime park. Moist, cool conditions near the shoreline and in the northeastern portion of the park support a northern boreal spruce-fir forest community, while somewhat drier conditions in the park's interior and southwestern portion favor northern hardwoods like sugar maple and yellow birch.

The main island contains a series of parallel ridges and valleys and a shoreline marked by numerous islands, narrow peninsulas, and bays. Ridges run southwest-northeast, generally with moderate slopes on the southeast aspect and steep slopes or cliffs on the northwest side. The highest point in the park is 1394 feet above sea level, almost 800 feet above Lake Superior.

While the park's fire history is not clearly understood, some researchers believe that pre-settlement fires were more severe and frequent than at present. The lack of landscape burning is a potential concern, particularly if moose food habits have altered vegetation and fuels in the park to the point of significantly modifying the pre-settlement vegetation communities and fire regime.

Since the beginning of the 20th century, fire suppression has been practiced in most of the region. For more than a decade at Isle Royale, park managers have operated under an approved 1992 Fire Management Plan (FMP) that allowed for a mix of strategies, including Wildland Fire Use, prescribed fire, and wildland fire suppression on three different Fire Management Units (FMUs) and a number of Fire Management Areas (FMAs). While the current (1992) fire management plan allows for prescribed fire, as of 2002, the National Park Service had utilized this tool only on a very limited basis; few prescribed fires have actually been conducted to date.

Together, the shortcomings of existing fire management practices and recent changes in federal fire policy necessitate a change in the park's FMP. Isle Royale's proposed action is a new FMP

responding to changes in federal fire policy and ongoing experience and evolving resource management priorities at the park.

An environmental assessment (EA) was prepared to better understand the environmental effects associated with five possible alternative FMPs at Isle Royale: 1) No Action (continue to implement the 1992 wildland FMP); 2) Modified No Action (Environmentally Preferred Alternative); 3) Complete Suppression of All Wildland Fires; 4) Emphasize Wildland Fire Use and Exclude Prescribed Fire; and 5) Emphasize Prescribed Fire and Exclude Wildland Fire Use. Environmental issues identified during scoping and evaluated in the EA included geology and soils, water resources, floodplains and wetlands, air quality, vegetation, wildlife and fisheries, threatened and endangered species, wilderness, noise, cultural resources, land use, socioeconomics, environmental justice/protection of children, human health and safety, public services, park facilities and operations, and visitor use and experience.

Preferred Alternative

Park management's preferred alternative is #2 – **Modified No Action.**

This alternative incorporates many elements of the existing, approved FMP, but includes modifications that will improve wildland fire and natural resources management in Isle Royale National Park.

Alternative 2 revises the park's existing Wildland Fire Management Plan to reflect recent NPS policy changes in the areas of safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles. Alternative 2 complies with NPS Director's Order #18, Wildland Fire Management and the Federal Wildland Fire Management Policy national standards.

Under Alternative 2, protecting human life is given highest priority. This alternative adopts the Canadian Fire Weather Indexes for fire danger rating and operational fire management decisions. It establishes two FMUs at Isle Royale: Suppression and Wildland Fire Use.

Suppression Unit

Under Alternative 2, Isle Royale's suppression unit includes several FMAs that provide protection for human life and property within the park's developed areas. The areas within the Suppression FMU include Mott Island and Davidson Island in their entirety, areas around the developments at Windigo, Rock Harbor, the North and South Shore Ranger Stations, lighthouses, some historic fishery locations, and several life lease cabins/islands in Tobin Harbor. Structures located outside these zones are protected (including life lease/fishery cabins), even though they are not explicitly located within a Suppression FMU.

All lightning and human-caused wildland fires originating from within or that threaten a Suppression FMU from outside are suppressed (managed) with the appropriate management response and analysis of the specific situation according to a Wildland Fire Situation Analysis (WFSA).

Mechanical fuel manipulation with power hand tools and prescribed fire are used to reduce fuels and accomplish vegetation management objectives within the Suppression FMU.

Wildland Fire Use Unit

Under Alternative 2, the Wildland Fire Use Unit continues to occupy about 95 percent of the park's land area. The unit's boundaries are designed to include all areas of the park except those that contain human developments or have continuous fuels contiguous to those developments. The objectives of this unit are to maximize the opportunities for fire to play its natural, crucial role in the ecosystem while fully protecting other values at risk.

In this FMU, most lightning-caused fires are allowed to burn under most weather conditions unless they threaten human life, property, or other critical resources. All wildland fires are monitored, re-evaluated, and approved daily. Lightning ignitions that do not satisfy prescription criteria and ongoing wildland fire use fires that exceed prescription will be reclassified as unwanted wildland fires and an appropriate management response will be taken according to a WFSA.

Wildland Fire Use fires that threaten natural or cultural resources (e.g. an active bald eagle nest or exposed archeological site) within this FMU are evaluated on a case-by-case basis and are subject to appropriate holding action. If necessary, naturally-ignited wildland fires are extinguished within this unit to avoid adverse impacts on irreplaceable resources.

Environmentally Preferred Alternative

The preferred alternative ("Modified No Action") is also the environmentally preferred alternative. The environmentally preferred alternative is the alternative that will promote the national environmental policy as expressed by §101 of the National Environmental Policy Act (NEPA). This includes alternatives that:

1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2) ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In essence, the Environmentally Preferred Alternative would be the one(s) that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (NPS, 2001).

In this case, the preferred alternative (#2 – Modified No Action) is the Environmentally Preferred Alternative for the new and revised Fire Management Plan for Isle Royale National Park, since it comes the closest to meeting goals 1, 2, 3, 4 and 6 above. Under this alternative, a combination of 1) expanded prescriptions for wildland fire use, 2) prescribed fires (if recommended by ongoing research) for habitat management and hazard fuel reduction, as well as 3) fire suppression, will all be used to protect human life and property, reduce hazardous fuel loadings in the park, simulate natural ecological processes, maintain a representative natural mosaic of climax, sub-climax and seral forest vegetation of different ages, and improve wildlife habitat. Finally, this alternative best protects and helps preserve the historic, cultural, and natural resources in the park for current and future generations.

The Preferred Alternative and Significance Criteria

As defined at 40 CFR §1508.27, from the regulations of the Council on Environmental Quality (CEQ) that implement the provisions of NEPA, significance is determined by examining the following criteria:

Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

There are overall benefits to the human and natural environment at Isle Royale from the proposed action. The preferred alternative in particular, would have positive effects on the health and safety of the park's visitors, staff, and neighboring residents, on its facilities and infrastructure, and on its vegetation communities, landscapes, wildlife habitat and populations, and threatened and endangered species. However, the preferred alternative does entail adverse impacts on a number of resource areas, including soils, water quality, floodplains and wetlands, air quality, wilderness, noise, cultural resources, public services, human health and safety, and visitor use and experience. These impacts range from localized to regional, and from temporary to long-term. None, however, rise to the level of significance.

The EA also discusses the minor to moderate impacts on air quality associated with the preferred alternative. The park enjoys generally high, though not pristine air quality at present. It is located in a Class 1 area for air quality, those that receive the greatest protection under the 1977

Clean Air Act Amendments. Wildland Fire Use, unwanted wildland fires and prescribed fires would all impinge to some extent on air quality, though not in a significant, sustained way. These impacts would be temporary and short-term, and minor to moderate during any one episode; moreover, they occurred even under natural or pre-European settlement conditions. Noise impacts from suppression and fuel reduction activities on designated Wilderness areas, which comprise almost 99% of the land area at Isle Royale National Park, are also considered to be temporary, localized, and negligible to minor over the long term.

The degree to which the proposed action affects public health or safety.

When conducting fire management activities, human health and safety is the primary concern. Under the preferred alternative, there would likely be very minor human health and safety impacts (small cuts and bruises) to firefighters resulting from wildland fire suppression and prescribed fire and thinning activities. The preferred alternative provides the best protection since prescribed fire and mechanical thinning will help reduce hazardous fuels near developed areas in the park and minimize the fire danger to the NPS staff, visitors, and nearby private residences and communities. Before conducting any prescribed fire, fire management officials would ensure that adequate weather conditions existed to facilitate smoke dispersion, thus minimizing and/or eliminating potential smoke impacts on sensitive receptors and the general public.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

As described in the EA, the intent of the action alternatives is to provide the maximum amount of protection for the important natural and cultural resources of the national park. The implementation of the preferred alternative would result in no significant adverse effects to known cultural resources (including archeological, historic, and ethnographic ones) since these would be identified, marked and avoided during fire management activities. The preferred alternative will have a long-term, moderately beneficial impact on the boreal coniferous forest and the northern hardwoods forest ecosystems, since fire is crucial to the maintenance and perpetuation of these ecosystems.

The degree to which the effects on the quality of the human environment are likely to be highly controversial.

There were no controversial impacts identified during the analysis done for the EA, and no controversial issues were raised during the public review of the EA. During public scoping, none of the more than 100 stakeholders or media outlets contacted raised any concerns or issues about the proposed action or its environmental impacts.

The degree to which the possible effects on the quality of the human environment are highly uncertain or involve unique or unknown risks.

The EA's analysis and public review identified no risks associated with the preferred alternative that are unique or unknown, nor effects associated with the preferred alternative that are highly uncertain. While botanists and fire ecologists cannot always predict the precise outcome when fire disturbs a given vegetation community, they have a broad understanding of the range of possible successional pathways that may result from a fire of a particular size and intensity, and they are continually refining this knowledge. Proposed Fire Effects Monitoring will help ensure that NPS fire and resource management staff continue to learn about the functioning of this ecosystem from their interventions, in keeping with the principles of adaptive resource management.

The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The preferred alternative does not establish a precedent for any future actions that may have significant effects, nor does it represent decisions about future considerations. The purpose of this action is to develop a fire management plan and program that recognizes the proper ecological role of fire in the management of Isle Royale's forests, plant communities and wildlife habitat, while minimizing the danger posed by hazardous fuel accumulations to human health, safety, and improved properties. Under such a program, mechanical thinning, and to some extent, prescribed burning activities would be conducted in phases over a number of years to improve forest health and wildlife habitat at Isle Royale. The effects of this program will be evaluated and, if necessary, the program will be revised during future revisions to Isle Royale's FMP.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.

Since the vegetation communities of Isle Royale are expected to thrive under a management regime that includes fire, the application of prescribed fire on a judicious basis, and the allowance for wildland fire use for resource benefits will cumulatively improve the health and diversity of the boreal coniferous forest and the northern hardwoods forest ecosystems present within the park. Similar efforts underway by other federal and state public land managers in northern Michigan, eastern Minnesota, and Ontario, Canada will expand the geographic extent of these cumulative beneficial impacts on forest composition and structure.

Due to the park's isolation, there are not expected to be any other cumulative effects from the proposed action, except possibly on air quality due to expanded use of prescribed fires in Michigan, Minnesota, and Ontario. In any case, the EA determined that there would be no significant cumulative impacts on any resources associated with the preferred alternative.

The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed on National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

Isle Royale National Park contains pre-European contact archeological sites as well as historic properties and structures listed on or eligible for the National Register of Historic Places. The

preferred FMP alternative includes a number of mitigation and avoidance measures to protect these irreplaceable resources and others that may await discovery.

NPS has complied with Section 106 of the National Historic Preservation Act, to the extent possible at present, by providing a copy of the draft FMP and preliminary draft EA to the Michigan State Historic Preservation Office (SHPO) in November of 2002. In early 2003, a SHPO representative indicated to Isle Royale's Cultural Resource Specialist that they had no comments on the FMP and EA.

The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

Isle Royale sent the East Lansing Field Office of the U.S. Fish and Wildlife Service (USFWS) a copy of the draft FMP and preliminary draft EA in November 2002. USFWS concurred with NPS that the endangered (now threatened) gray wolf and the threatened bald eagle were the only federally listed species found in the park. NPS worked closely with USFWS to develop language and mitigation measures concerning protection of eagle nests, wolf pups, and wolf critical habitat in the EA.

Given that wildland fires which threaten active bald eagle nests would be suppressed, USFWS determined that implementation of the Plan would result in beneficial effects to bald eagle.

USFWS also determined that "Implementation of the proposed Plan would lead to long term beneficial affects (sic) to gray wolves and their critical habitat. Wildland fires and prescribed fires may increase moose populations by spurring growth of new woody and herbaceous vegetation. This may benefit the gray wolf by improving prey availability".

The full text of USFWS' concurrence letter will be part of the administrative record for this FMP and its EA. The determinations of "not likely to adversely affect" for the bald eagle, the gray wolf, and gray wolf critical habitat are part of the final EA.

Whether the action threatens a violation of Federal, state, or local law or requirements imposed for the protection of the environment.

This action violates no federal, state, or local environmental protection laws.

Impairment

In addition to reviewing the list of significance criteria, the National Park Service has determined that implementation of the proposal will not constitute an impairment to the critical resources and values of the national park. This conclusion is based on a thorough analysis of the environmental impacts described in the FMP and its EA, public comment, relevant scientific studies, and the professional judgment of the decision-maker guided by the direction in NPS *Management Policies 2001* (December 27, 2000). The plan under the preferred alternative will result in minor to at most moderate adverse impacts to air quality resources, primarily in the form of smoke impacts to visibility, and to designated Wilderness, primarily in the form of

elevated noise levels. Overall, the plan results in benefits to park resources and values, and opportunities for their enjoyment, and it does not result in their impairment.

Public Involvement

Isle Royale Natural Resource Management staff began scoping for the EA on updating the park's Wildland FMP in December 2001, with a news release. The news release was mailed to approximately 110 addressees, including elected officials, the Michigan SHPO, non-governmental organizations (NGOs), and the news media. The news release and letter requested comments on issues that needed to be addressed in the new FMP and suggestions on various possible ways to manage the park's fire management program. Persons and parties interested in commenting in writing were requested to have their letters postmarked no later than January 18, 2002.

As part of the scoping effort, Isle Royale cultural resources staff conducted mandatory consultation with affiliated tribes. Park staff received no scoping comments from the public, stakeholders, tribes, the SHPO or other agencies. There were no substantive issues or objections raised upon review of the Draft EA and its associated Draft FMP.

The preferred alternative does not constitute an action that normally requires preparation of an environmental impact statement (EIS). The preferred alternative will not have a significant effect on the human environment. Negative environmental impacts that could occur are generally negligible or minor in intensity, with the only moderate impacts being of temporary or short-term duration. There are no significant impacts on public health, public safety, threatened or endangered species, sites or districts listed in or eligible for listing in the National Register of Historic Places, or other unique characteristics of the region. No highly uncertain or controversial impacts, unique or unknown risks, significant cumulative effects, or elements of precedence were identified. Implementation of the action will not violate any federal, state, or local environmental protection law.

Based on the foregoing, it has been determined that an EIS is not required for this proposed action and thus will not be prepared.

Recommended: _____ 9/28/04
Acting Superintendent, Isle Royale National Park Date

Approved: _____ 10-12-04
Midwest Regional Director Date

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Isle Royale National Park

Keweenaw County, Michigan

Fire Management Plan

Final Environmental Assessment

September 2004

U.S. Department of the Interior
National Park Service

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Errata

Page 4-29: Third bullet at the top of the page should read:

- *Bald Eagle* – not likely to adversely affect

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Chapter 1
INTRODUCTION

Isle Royale National Park was authorized by Congress in March, 1931. The park protects a remote island archipelago consisting of one large, central island (Isle Royale) approximately 45 miles long and 9 miles wide surrounded by about 400 smaller islands (NPS, 1998). The Isle Royale archipelago is oriented along a northeast/southwest axis and is located in the isolated northwestern reaches of Lake Superior, about 60 miles north of Michigan's Keweenaw Peninsula, 22 miles east of Grand Portage, Minnesota, and 35 miles south of Thunder Bay, Ontario (see Figures 1.0-1 and 1.0-2).

Isle Royale is primarily a North Woods wilderness and maritime park. Moist, cool conditions near the shoreline and in the northeastern portion of the park support a northern boreal spruce-fir forest community, while somewhat drier conditions in the park's interior and southwestern portion favor northern hardwoods like sugar maple and yellow birch. In a classic illustration of island biogeography (MacArthur and Wilson, 1967), fewer species of fauna are found on Isle Royale than on the mainland, because its isolation and size make it difficult for wildlife first to reach, and then maintain viable, healthy population sizes. The island's most famous residents are its moose and wolves, but at least 12 other mammals are present. Birds are similar to those of the mainland, but less is known of amphibians and reptiles. Isle Royale's fish, particularly its populations of lake trout, coaster brook trout, and herring, are one of its most outstanding attributes.

Human activity on Isle Royale dates back more than four millennia, when Native Americans became the first to mine the island's copper deposits. Beginning in the 1800's, it was subjected to a succession of commercial exploits by Europeans and Americans, including trapping, copper mining, fishing, logging, and vacationing.

The park is accessible by means of ferry and seaplane from Michigan's Upper Peninsula and from Minnesota, as well as by private boat. It is open to the public from mid-April through October; the park is closed from November into April to minimize human impacts on wildlife and the park's wildlife research program that occurs in these months. Visitors arrive to motorboat, canoe, kayak, fish, scuba dive, camp, hike and backpack. The park boasts 165 miles of hiking trails.

The park's purposes, as described in its 1998 General Management Plan (NPS, 1998), include the following:

- Preserve and protect the park's wilderness character for use and enjoyment by present and future generations;
- Preserve and protect the park's cultural and natural resources and ecological processes;
- Provide opportunities for recreational uses and experiences that are compatible with the preservation of the park's wilderness character and park resources;

Figure 1.0-1

Regional Context of Isle Royale National Park

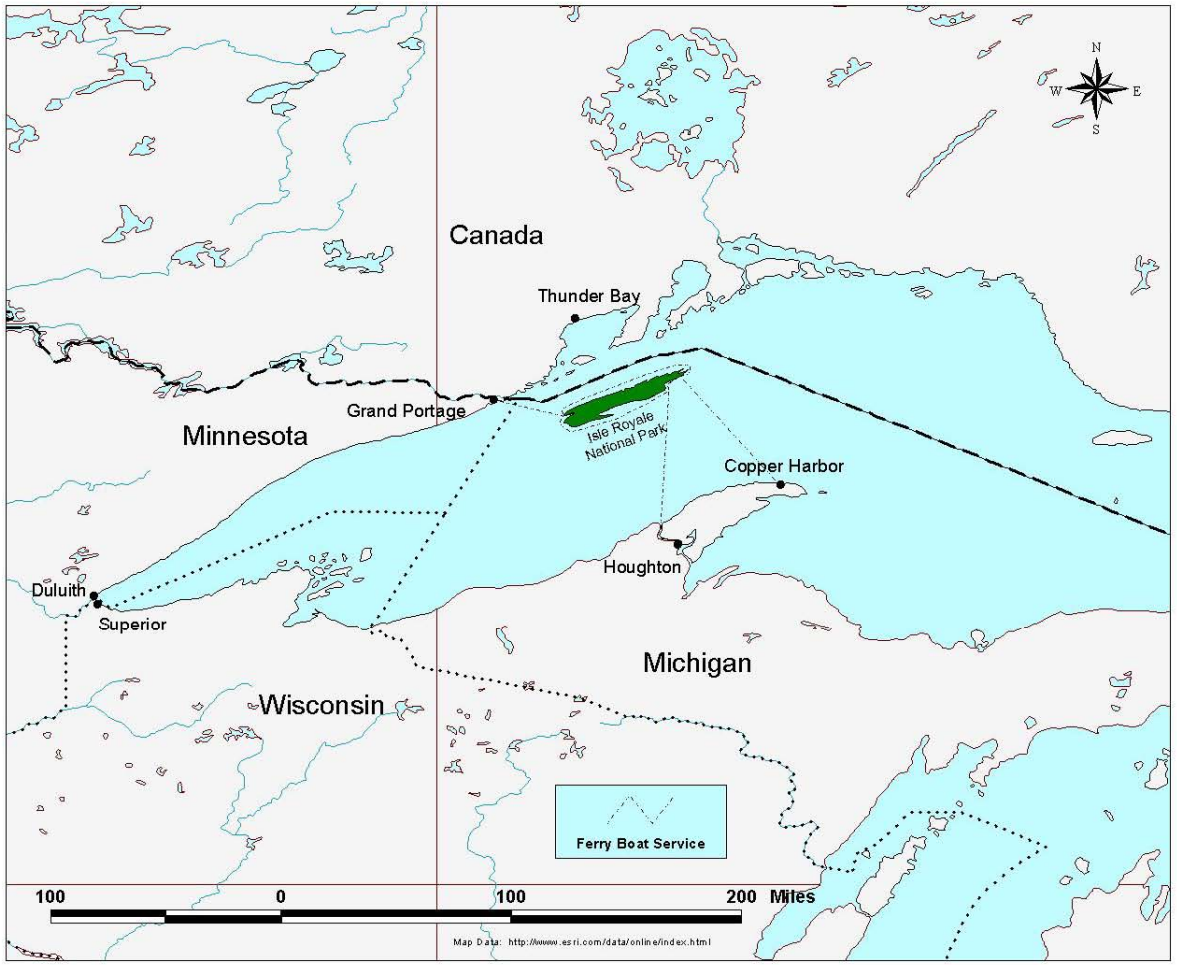
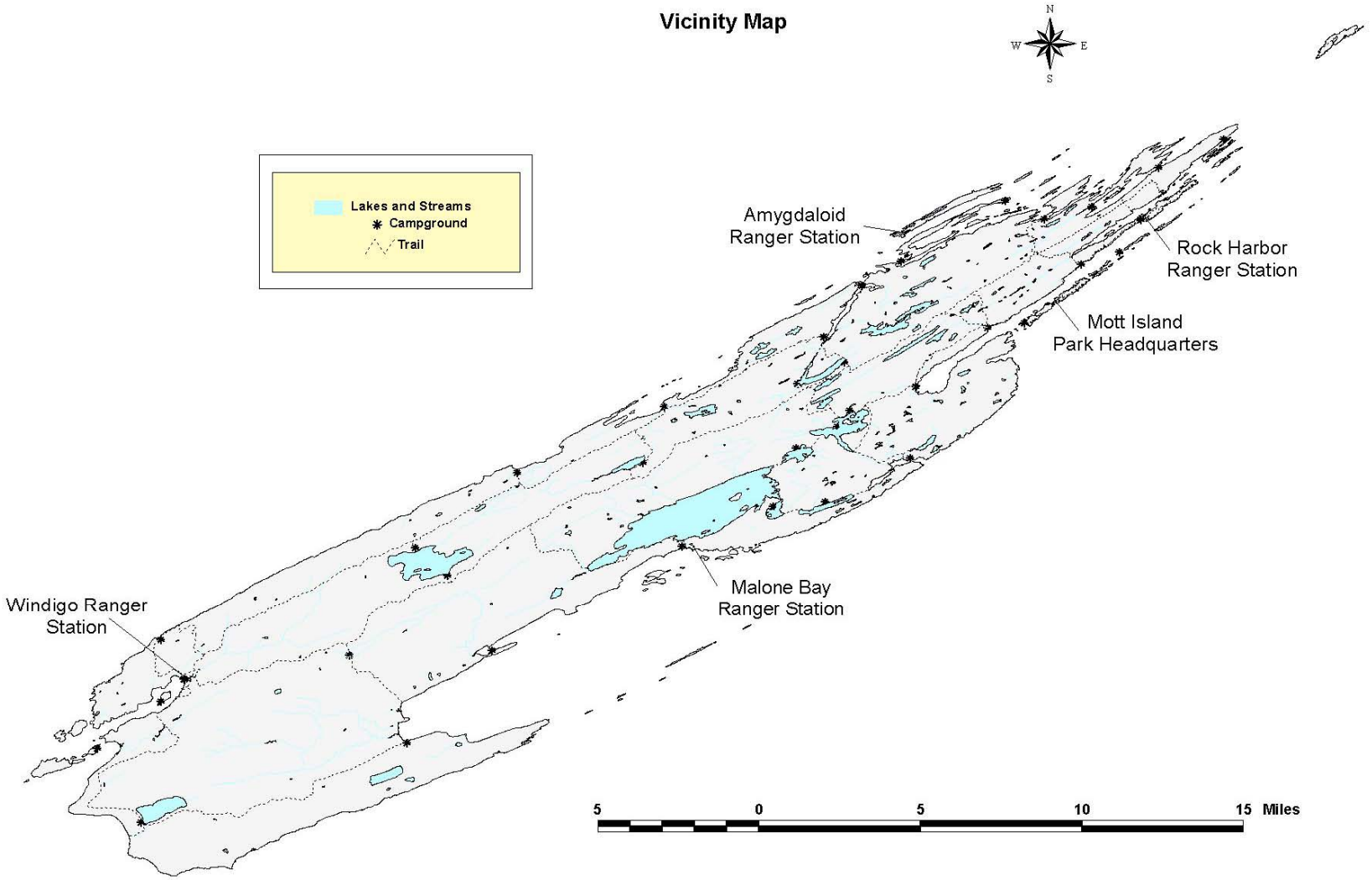


Figure 1.0-2


Vicinity Map
N
W
E
S
Lakes and Streams
Campground
Trail
Amygdaloid
Ranger Station
Rock Harbor
Ranger Station
Mott Island
Park Headquarters
Malone Bay
Ranger Station
Windigo Ranger
Station
5
0
5
10
15 Miles

- Provide park-related educational and interpretive opportunities for the public;
- Provide opportunities for scientific study of ecosystem components and processes, including human influences and use, and share findings with the public.

Park staff and the public have attempted to capture the uniqueness of Isle Royale in the following significance statements:

- This maritime park, a U.S. Biosphere Reserve, encompasses a remote and primitive wilderness archipelago isolated by the size and power of Lake Superior.
- Isle Royale is world renowned for its long-term wolf/moose predator/prey study. The park offers outstanding possibilities for research in a remote, relatively simple ecosystem where overt human influences are limited.
- Park waters contain the most productive native fishery and genetically diverse lake trout populations in Lake Superior.

Isle Royale's distinctive character was recognized in 1976 when Congress designated 98% of the park as federal Wilderness; later additions brought the total to 99%. The park's international significance was acknowledged in 1980 when it was named a U.S. Biosphere Reserve as part of the United Nations' Man and Biosphere Programme.

1.1 PURPOSE AND NEED FOR FEDERAL ACTION

This Environmental Assessment (EA) documents the results of a study of the potential environmental impacts of an action proposed by the National Park Service to amend the Isle Royale National Park Fire Management Plan (FMP).

This EA has been prepared in compliance with:

The National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), which requires an environmental analysis for major federal actions having the potential to impact the quality of the environment;

Council of Environmental Quality Regulations at 40 Code of Federal Regulations (CFR) 1500-1508, which implement the requirements of NEPA;

National Park Service Conservation Planning, Environmental Impact Analysis, and Decision Making: Director's Order (DO) #12 and Handbook.

The Purpose of an Environmental Assessment (EA)

There are three primary purposes of an EA:

- To help determine whether the impact of a proposed action or alternative could be significant, thus an environmental impact statement (EIS) is needed;
- To aid in compliance with NEPA when no EIS is necessary by evaluating a proposal that will have no significant impacts, but that may have measurable adverse impacts; and
- To facilitate preparation of an EIS if one is necessary.

A key goal of NEPA is to help federal agency officials make well-informed decisions about agency actions. The study and documentation mechanisms associated with NEPA seek to provide decision-makers with sound knowledge of the comparative environmental consequences of the several courses of action available to them. NEPA studies, and the documents recording their results, such as this EA, focus on providing input to the particular decisions faced by the relevant officials. In this case, the Superintendent of Isle Royale is faced with a decision to amend the park's Fire Management Plan as described below. This decision will be made within the overall management framework already established in the Isle Royale National Park General Management Plan (GMP), approved in 1998. The alternative courses of action to be considered at this time are, unless otherwise noted, crafted to be consistent with the concepts established in the GMP.

1.1.1 Need for Action

Isle Royale National Park has an approved FMP dating from 1992 (ISRO, 1992), but changes in federal fire policy since that time necessitate a change in the park's FMP.

The 1995 Final Report of the Federal Wildland Fire Management Policy and Program Review provides guiding principles that are fundamental to the success of the federal wildland fire management program and implementation of review recommendations. These recommendations include federal wildland fire policies in the areas of: safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles.

The Federal Wildland Fire Management Policy that now governs wildland fire management provides for a full range of responses and the opportunity for wildland fires to be managed for resource benefits. This policy represents a significant departure from past fire management practices. All ignitions occurring in wildland areas are now classified as wildland fires or prescribed fires. Wildland fires include any non-structure fire, other than prescribed fire, that occurs in the wildland, regardless of whether its origin is natural (generally lightning) or human (accident or arson). All wildland fires not capable of supporting resource management will receive a suppression response. The term wildland fire encompasses fires previously called both wildfires and prescribed natural fires. Prescribed fires include any fire ignited by management actions to meet specific objectives. This term replaces management-ignited prescribed fire. Prior to the ignition of prescribed fires, a written, approved prescribed fire plan must exist, per Reference Manual-18 (RM-18, on wildland fire management), chapter 10, and NEPA requirements must be met. This EA constitutes the requisite NEPA documentation and compliance for the FMP.

Wildland fires are any non-structure fires, other than prescribed fires, that occur in the wildland. This term encompasses fires previously called both wildfires and prescribed natural fires.

Prescribed Fires are any fires ignited by management actions in defined areas under predetermined weather and fuel conditions to meet specific objectives.

Wildland fire use is the management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outlined in Fire Management Plans.

Prescribed fires are authorized by approved resource and fire management plans and contribute specifically to a park's resource management goals and objectives. Wildland fires are managed with the appropriate management response as directed by the park's fire management plan and analysis of the specific situation. These fires can be managed entirely or in any part for resource benefits or receive suppression actions to minimize burned area due to high values to be protected, threats to life or property, or other social, political, and economic considerations that outweigh potential environmental benefits. A decision-making process is implemented that evaluates and compares alternative management strategies with respect to safety, environmental, social, economic, political, and resource management goals.

An approved FMP is required before a wildland fire management program can be fully implemented. The use of either prescribed fire or wildland fire use is expressly not permissible without an approved FMP. The need for wildland fire use is described in the park's Resources Management Plan (ISRO, 1999), while specific fire use activities must be updated and described in the park's FMP. The Superintendent approves the FMP and implementation plans for all fire management activities.

Under the 1992 FMP, three Fire Management Units (FMU's) are delineated in the park. Approximately 95% of Isle Royale is in the Wildland Fire Use FMU (formerly called the Prescribed Natural Fire Management Unit), which allows lightning fires to burn under most circumstances. Hypothetically, this allows ecologically-significant fires to burn. However, even though several lightning strikes did occur in the 1990's under drought conditions favoring the spread of fire, little area actually burned. While the park's fire history is not clearly understood, some researchers believe that pre-settlement fires were more severe and frequent than at present (Cole et al., 1995). The lack of landscape burning is a potential concern, particularly if moose food habits have altered vegetation and fuels in the park to the point of significantly modifying the pre-settlement vegetation communities and fire regime. A more aggressive strategy to re-introduce fire back into the park landscape via prescribed fire is under now under investigation and review; the preferred alternative (#2) will allow for the use of prescribed fire in the Wildland Fire Use Fire Management Unit if this review concludes it would be beneficial.

Finally, a new system of fire danger rating and operational fire management decisions is needed to improve the existing system at the park, which does not work as well as others that are available and in use.

1.1.2 Purpose for Action

The purpose of this federal action is to provide a long-range fire management plan and program at Isle Royale National Park utilizing the benefits of fire to achieve desired natural resource conditions while protecting human lives and park resources from fire. NPS policy recommends an annual review of the FMP and a revision every five years.

The Proposed Action is implementation of a long-range Wildland Fire Management Plan. This EA analyzes a range of reasonable long-range fire management program alternatives and their direct, indirect and cumulative impacts. Five alternatives are analyzed. The NPS-preferred

alternative is #2 – the Modified No Action Alternative. The preferred alternative utilizes three Fire Management Units: 1) Wildland Fire Use (WFU), and 2) Suppression. Both units would allow for prescribed fire under specific conditions or prescriptions; fire suppression may occur in all three units as well. WFU, however, is permitted only in the first FMU (i.e. not in the Suppression unit). The preferred alternative also incorporates recent changes in federal wildland and prescribed fire management policy (NIFC, 1998) and adopts the Canadian Fire Weather Indexes for fire danger rating and operational fire management decisions.

1.2 OBJECTIVES OF FIRE MANAGEMENT AND PLANNING

The objectives of fire management and planning at Isle Royale remain relatively unchanged from those in the 1992 FMP. Only the priority attached to each and the order is different.

- **Protect human life, property, and irreplaceable natural and cultural resources from unwanted fire.**

- **To the extent possible given other objectives for protecting human life and property, allow fire to achieve its natural role in the ecosystem to perpetuate natural ecosystem processes.** This will assist in maintaining and restoring native wildlife species by maintaining a natural diversity of different kinds of plant communities. It will also limit opportunities for large, catastrophic fires, and disease and insect epidemics to spread by maintaining a representative natural mosaic of climax, subclimax and seral forest vegetation of different ages.

- **Use prescribed fire to accomplish other specific resource management goals.** These goals may include the replacement of natural fire, protection or restoration of critical plant or animal habitats or communities, elimination of alien species, the restoration of historic scenes (e.g. Daisy Farm meadow), and/or the reduction in hazardous fuel conditions.

- **Minimize, and where necessary, mitigate unacceptable impacts of wildfire and fire suppression.** This includes resource damage, aesthetic considerations, and waste of government funds.

- **Minimize unplanned human-caused ignitions.**

- **Promote public understanding of fire management programs and objectives.**

- **Integrate fire management with all other aspects of park management.**

- **Monitor and evaluate fire effects.**

1.3 PUBLIC AND AGENCY SCOPING

NEPA requires federal agencies to invite public involvement prior to decision-making on proposed actions that may affect the environment. "Scoping" is the process of soliciting input from "stakeholders" – including internal NPS staff, the public, and other agencies – at the outset of a NEPA analysis. Not only may the information obtained from interested and knowledgeable parties be of value in and of itself, but the perspectives and opinions as to which issues matter the most, and how, indeed whether, the agency should proceed with a given proposed action are equally important. Input from scoping thus helps shape the direction that analysis takes helping planners and analysts decide which issues merit consideration. Public input also helps in the development of alternatives to the proposed action, which is an integral part of NEPA.

Isle Royale Natural Resource Management staff began scoping for the EA on updating the park's Wildland FMP in December, 2001, with a news release (see Appendix D). The news release was mailed to approximately 110 addressees, including elected officials, the Michigan State Historic Preservation Officer (SHPO), non-governmental organizations (NGO's), and the news media. The news release and letter requested comments on issues that need to be addressed in the new FMP and suggestions on various possible ways to manage the park's fire management program. Persons and parties interested in commenting in writing were requested to have their letters postmarked no later than January 18, 2002.

As part of the scoping effort, Isle Royale cultural resources staff conducted mandatory consultation with affiliated tribes. Park staff received no scoping comments from the public, stakeholders, tribes, the SHPO and other agencies.

1.4 IMPACT TOPICS INCLUDED IN THI S EA

In the absence of scoping input from the public and other agencies, park staff and consultants pooled their experience and expertise to derive a list of issues and related impact topics. Not every conceivable impact of a proposed action is substantive enough to warrant analysis. The following topics, however, do merit consideration in this EA:

Geology and Soils: Soils can potentially be adversely affected by intense fires as well as by suppression activities. Therefore, impacts to soils and geology are analyzed in this EA.

Water Resources: NPS policies require protection of water resources consistent with the Federal Clean Water Act. Lake Superior itself contributes over 438,000 acres to Isle Royale National Park, the majority of the park's area. These cool, clean waters contain the most productive native fishery and genetically diverse lake trout populations in all of Lake Superior. In addition, some 200 inland lakes and ponds dot Isle Royale. Both wildland fires and prescribed fire can adversely affect water resources by exposing soils, which leads to erosion during storm events and subsequent suspended solids and turbidity in downstream surface waters. Therefore, impacts to water resources are analyzed in this EA.

Floodplains and Wetlands: Presidential Executive Orders mandate floodplain management and protection of wetlands. The park has numerous wetlands, including marshes, bogs, and vegetated lake and pond shores. Wetlands support considerable biodiversity. Fires and to a lesser extent fire suppression activities can influence floodplains and wetlands, and therefore impacts to both are analyzed in this EA.

Air Quality: The Federal 1970 Clean Air Act stipulates that federal agencies have an affirmative responsibility to protect a park's air quality from adverse air pollution impacts. Moreover, Isle Royale is located in a mandatory Class I area, which are afforded the highest degree of protection under the Clean Air Act. While the park generally enjoys exceptional air quality, it is not pristine air quality. All types of fires generate smoke and particulate matter, which will impinge on air quality in the park and surrounding region to some extent. Moreover, the extensive forests in both the U.S. and Canadian portions of this border region are subject to both natural and human-caused wildland fires, as well as prescribed fire. All of these considerations recommend the inclusion of impacts to air quality in this analysis.

Vegetation: Isle Royale is located at the ecotone or transition zone between the boreal and northern hardwood forest ecosystems. Its plant communities are among its most important assets. Moreover, forests and flora more generally are strongly influenced by fire regimes. Therefore, this EA will consider the impacts of the proposed FMP alternatives on the park's vegetation.

Wildlife and Fisheries: Isle Royale's pioneering, long-term wolf-moose study is famous among wildlife biologists worldwide. The isolation of the park's relatively simple ecosystem limits the potency of human influences. Also, park waters contain over 60 species of fish, including outstanding populations of trout and whitefish. Fire management has marked effects on the forested wildlife habitat that predominates in the park, and thus indirectly on wildlife populations. Fisheries can be indirectly impacted if erosion and turbidity occur subsequent to fires or suppression efforts. Therefore, impacts of the FMP alternatives on wildlife and fisheries are evaluated in this EA.

Threatened and Endangered Species: The Federal Endangered Species Act prohibits harm to any species of fauna or flora listed by the U. S. Fish and Wildlife Service (USFWS) as being either threatened or endangered. Such harm includes not only direct injury or mortality, but also disturbing or destroying the habitat on which these species depend. Two federal threatened or endangered species – the bald eagle and the timber wolf – inhabit Isle Royale. The Michigan Department of Natural Resources also publishes a list of species threatened and endangered within the state. Among state-listed animal species occurring on Isle Royale are the moose, common loon, and osprey. Over 75 state-listed plant species are also documented in the park. Since these organisms depend on habitat conditions that are strongly influenced by fire or fire exclusion, this EA considers the effect of the FMP on threatened and endangered species known to occur in the park.

Wilderness: The 1964 Wilderness Act states that wilderness, "in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who

does not remain" (16 USC 1121 (note), 1131-1136). This statute established a National Wilderness Preservation System; designated areas in that system are to be left unimpaired for future use and enjoyment. Approximately 99% of Isle Royale National Park is designated by Congress as Wilderness. Moreover, the park's wilderness character is highlighted in both its purpose and significance statements. Since wildland fires, prescribed fire, and fire suppression can affect wilderness values, the impact of the proposed FMP alternatives is addressed in this EA.

Noise: Noise is defined as unwanted sound. Mechanical fuel reduction, prescribed fire and fire suppression efforts can all involve the use of noise-generating mechanical tools and devices with engines, such as chain saws, pumps, motor boats, helicopters, and airplanes. Some these devices, in particular helicopters and chain saws at close range, are quite loud (in excess of 100 decibels). NPS management policies call for the preservation of, "to the greatest extent possible, the natural soundscapes of parks" (NPS, 2000; Section 4.9). In addition, the fact that 99% of Isle Royale is designated by Congress as part of the National Wilderness Preservation System means that the park environment is especially sensitive to intrusive, mechanical noise. NPS policy requires that national parks consider the potential impacts of motorized equipment on the character, aesthetics, and traditions of wilderness (NPS, 2000; Section 6.3.4.3). Thus, noise impacts are addressed in this EA.

Cultural Resources: Section 106 of the National Historic Preservation Act of 1966 provides the framework for federal review and protection of cultural resources, and ensures that they are considered during federal project planning and execution. One of the purposes in Isle Royale's enabling legislation is for it to "preserve and protect the park's cultural…resources…." Isle Royale contains considerable evidence of both pre-historic and historic human occupation and use dating back more than 4,500 years. These cultural resources can be affected both by fire itself and fire suppression activities. Thus, potential impacts to cultural resources will be addressed in this EA.

Human Health and Safety: Fires can be extremely hazardous, even life-threatening, to humans, and current federal fire management policies emphasize that firefighter and public safety is the first priority; all FMP's must reflect this commitment (NIFC, 1998). Therefore, impacts to human health and safety are addressed in this EA.

Park Operations: Severe fires can potentially affect operations at national parks, especially in more developed sites such as visitor centers, campgrounds, administrative and maintenance facilities. These impacts can occur directly from the threat to facilities of an approaching fire, and more indirectly from smoke and the diversion of personnel to firefighting. Fires have caused closures of facilities in parks around the country. Thus, the potential effects of the FMP alternatives on park operations will be considered in this EA.

Visitor Use and Experience: The 1916 NPS Organic Act directs the Service to provide for public enjoyment of the scenery, wildlife and natural and historic resources of national parks "in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations." Public enjoyment, education and recreation are emphasized in Isle Royale's purpose statements. Both wildland fires and prescribed fires can have temporary and long-term

impacts on recreation and enjoyment of the park by the public. Therefore, the potential impacts of the proposed FMP on visitor use and experience are addressed in this EA.

1.5 IMPACT TOPICS CONSIDERED BUT DROPPED FROM FURTHER ANALYSIS

NEPA and the CEQ Regulations direct agencies to "avoid useless bulk…and concentrate effort and attention on important issues" (40 CFR 1502.15). Analysts must use their professional judgment in deciding which issues warrant consideration and to what extent.

Certain impact topics that are sometimes addressed in NEPA documents on other kinds of proposed actions or projects have been judged to not be substantively affected by any of the FMP alternatives considered in this EA. These topics are listed and briefly described below, and the rationale provided for not considering them in any more detail.

Waste Management: None of the FMP alternatives will generate noteworthy quantities of either hazardous or solid wastes that need to be disposed of in hazardous waste or general sanitary landfills. Therefore this impact topic is dropped from additional consideration.

Transportation: Due to Isle Royale's isolated location in Lake Superior, with the nearest roads, railroads, and airports more than 20 miles away in Ontario, there will be virtually no adverse impacts from the various FMP alternatives on ground or aerial transportation. The park contains no roads open to motorists. Isle Royale's harbors and marinas would probably not be affected by smoke from a wildland fire or wildlife except under very rare and extreme conditions, at which time, the most that would happen is temporary closure of these facilities. While a major shipping lane does pass through park waters (between Blake's Point and Passage Island), because the ships sailing through this area are all equipped with navigational equipment, they would not be affected even during infrequent periods of heavy smoke. Therefore, this topic is dismissed from any further analysis.

Public Utilities: Generally speaking, some kinds of projects, especially those involving construction, may temporarily impact above and below-ground telephone, electrical, natural gas, water, and sewer lines and cables, potentially disrupting service to customers. Other proposed actions may exert a substantial, long-term demand on telephone, electrical, natural gas, water, and sewage infrastructure, sources, and service, thereby compromising existing service levels or causing a need for new facilities to be constructed. Due to Isle Royale's isolation and the complete absence of any such public utilities in the park (except those self-contained systems serving staff and visitors in the few developed areas), none of the FMP alternatives will cause any of these impacts to any extent, and therefore utilities are eliminated from any additional analysis.

Land Use: Isle Royale National Park is completely surrounded by Lake Superior. Thus, the park's remoteness and complete isolation from any surrounding land uses in either the United

States or Canada means that this issue, which is typically addressed in EA's and EIS's, is not relevant in this case. Therefore, this topic is dismissed from any further analysis.

Socioeconomics: As with some of the topics dismissed above, Isle Royale's isolation is a major factor, but not the only one, in the dismissal of socioeconomic effects from more detailed analysis in this EA. In the 1990's, annual visitation to the park averaged about 17,000. This visitation generates regional economic activity, by supporting jobs within the NPS (inside and outside the park itself), concessionaires, and supporting services, like passenger boats, seaplanes, and outdoor equipment supply. Visitors also generate expenditures on goods and services, which ripple through the regional economy, including places like Houghton, the Keweenaw Peninsula of Michigan's Upper Peninsula and the Grand Portage area of Minnesota. Over the long term, prescribed fires and fire suppression associated with the various alternatives considered in this EA will have no more than negligible effects, either positive or negative, on Isle Royale's visitation and regional economic significance. Likewise, the employment associated with prescribed fires and fire suppression is negligible in terms of overall employment in gateway counties (Houghton, Keweenaw, Ontonagon, and Cook) of Michigan and Minnesota. Therefore, this topic is dismissed from any further consideration.

Environmental Justice / Protection of Children: Presidential Executive Order 12898 requires federal agencies to identify and address disproportionate impacts of their programs, policies and activities on minority and low-income populations. Executive Order 13045 requires federal actions and policies to identify and address disproportionately adverse risks to the health and safety of children. These topics are irrelevant to this EA because of the park's isolation in Lake Superior. There are no residential neighborhoods adjacent to Isle Royale and thus none with disproportionately high percentages of minorities or low-income residents. Likewise, there are no schools, theme parks, or playgrounds on Isle Royale, or any other facility or attraction that would disproportionately concentrate children and thus make them any more vulnerable to wildland fires and fire management activities than the adult population as a whole. Children do visit the park with their families and some park personnel have their children with them at Mott Island when the park is open, but the health and safety of these children are not at disproportionate risk from the various FMP alternatives. Thus, this topic is dropped from any further analysis.

Public Services: In general, some kinds of projects or programs subject to NEPA analysis can interfere with the operation of or add to the burden on public services like police, municipal fire-fighting, emergency medical, and search & rescue. Since municipal, county or state-run public services like these are all but absent at Isle Royale, this topic is not considered any further in this EA.

Chapter 2
ALTERNATIVES INCLUDING THE PROPOSED ACTION

The National Environmental Policy Act or NEPA (42 U.S.C. 4321, as amended) and the Council on Environmental Quality Regulations (40 CFR 1500-1508) mandate federal agencies to present and analyze alternatives to their proposed actions. The National Park Service's NEPA regulations (DO-12) reinforce this mandate, directing the NPS to examine a full range of alternatives both in an Environmental Impact Statement (EIS) and in an Environmental Assessment (EA). Accordingly, this EA develops and analyzes five alternatives for the proposed new Fire Management Plan (FMP) for Isle Royale National Park.

The 1995 Final Report of the Federal Wildland Fire Management Policy and Program Review and the 2001 policy update provide guiding principles that are fundamental to the success of the federal wildland fire management program and implementation of review recommendations. These recommendations include federal wildland fire policies in the areas of: safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles.

The Federal Wildland Fire Management Policy that now governs wildland fire management provides for a full range of responses and for the opportunity for wildland fires to be managed for resource benefits. This policy represents a significant departure from past fire management practices. All ignitions occurring in wildland areas are now classified as wildland fires or prescribed fires. Wildland fires include any non-structural fire, other than prescribed fire, that occurs in the wildland. The term wildland fire encompasses fires previously called both wildfires and prescribed natural fires. All wildland fires not capable of supporting resource management will receive a suppression response. Prescribed fires include any fire ignited by management actions to meet specific objectives. This term replaces management-ignited prescribed fire. Prior to the ignition of prescribed fires, a written, approved prescribed fire plan must exist, and NEPA requirements must be met (RM-18, Chapter 10).

Approved resource and fire management plans authorize prescribed fires that contribute specifically to a park's resource management objectives. Wildland fires are managed with the appropriate management response as directed by the park's FMP and analysis of the specific situation, i.e. the Wildland Fire Situation Analysis (WFSA). These fires can be managed entirely or in any part for resource benefits or be suppressed to minimize burned area due to high values to be protected, threats to life or property, or other social, political, and economic considerations that outweigh potential environmental benefits. Fire management personnel implement a decision-making process that evaluates and compares alternative management strategies with respect to safety, environmental, social, economic, political, and resource management objectives.

An approved FMP is required before a wildland fire management program can be fully implemented. The use of either prescribed fire or wildland fire use are expressly not permissible without an approved FMP. The need for wildland fire use is described in the park's Resources Management Plan (1999), while specific fire use activities must be updated and described in the park's FMP. The Superintendent approves the FMP and implementation plans for all fire use activities.

In the present context, the proposed action is a new Fire Management Plan that will update and replace the FMP approved in 1992. Director's Order (DO) #18, Wildland Fire Management, which took effect in 1998, requires each park with vegetation capable of sustaining fire to develop a wildland fire management plan that will meet the specific resource management objectives for that park and to ensure that firefighter and public safety are not compromised.

The five alternatives discussed below represent different approaches to managing wildland and prescribed fires in Isle Royale National Park.

2.1 ALTERNATIVE 1 – NO ACTION (IMPLEMENT CURRENT WILDLAND FIRE MANAGEMENT PLAN)

This alternative continues current NPS fire management practices at Isle Royale National Park. Park managers are currently operating under an FMP approved in 1992. Under the No Action Alternative, this FMP is only modified to reflect changes in terminology. The present FMP is not updated to reflect recent NPS policy changes.

The following objectives from the current, approved (1992) FMP for Isle Royale National Park, and under Alternative 1, are maintained:

- **Allow fire to achieve its natural role in the ecosystem to perpetuate natural ecosystem processes.** This assists in maintaining and restoring native wildlife species by maintaining a natural diversity of different kinds of plant communities. It also limits opportunities for large, catastrophic fires, and disease and insect epidemics to spread by maintaining a representative natural mosaic of climax, sub-climax and seral forest vegetation of different ages.

- **Protect human life, property, and irreplaceable natural and cultural resources from unwanted fire.**

- **Use prescribed fire to accomplish other specific resource management objectives.** These objectives may include the replacement of natural fire, protection or restoration of critical plant or animal habitats or communities, elimination of alien species, the restoration of historic scenes (e.g. Daisy Farm meadow), and/or the reduction in hazardous fuel conditions.

- **Minimize, and where necessary, mitigate unacceptable impacts of wildland fires and fire suppression.** These include resource damage, aesthetic considerations, and waste of government funds.

- **Avoid unplanned human-caused ignitions.**

- **Promote public understanding of fire management programs and objectives**.

- **Integrate fire management with all other aspects of park management.**

- **Monitor and evaluate fire effects to determine whether management objectives were met.**

The 1992 FMP establishes three FMUs on Isle Royale National Park: the Suppression Unit, Wildland Fire Use Unit (formerly Prescribed Natural Fire Management Unit), and Conditional Fire Management Unit. Alternative 1 maintains these three FMUs. Each unit has a unique set of fire management objectives that can be met by a specific prescription. Figure 2.1-1 depicts Alternative 1's FMUs.

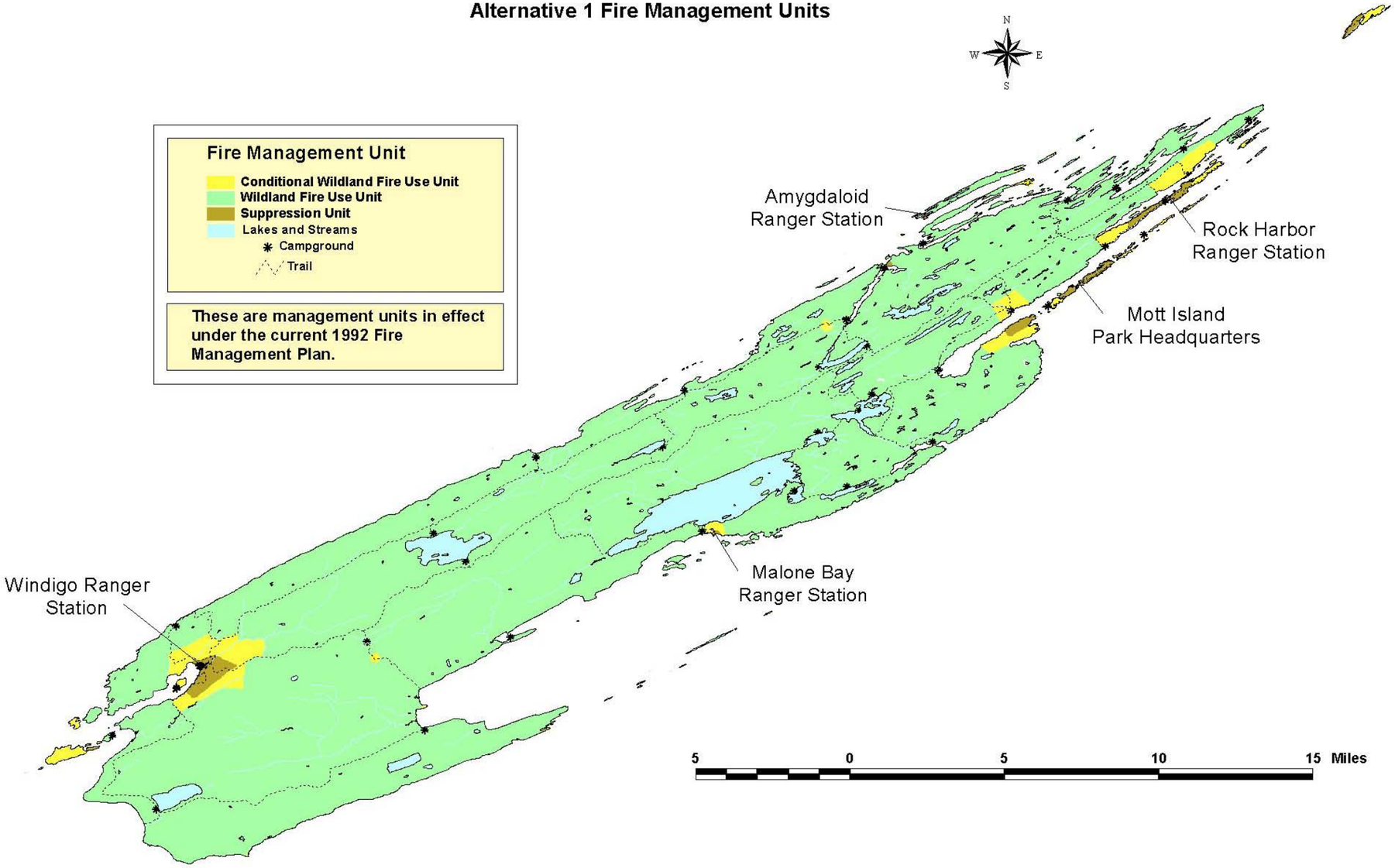
Suppression Unit

Isle Royale's suppression unit contains several Fire Management Areas (FMAs) that provide protection for human life and property within the park's developed areas. These areas include Mott Island, Davidson Island, and East Caribou Island in their entirety, as well as zones centered on Rock Harbor, Windigo, North and South Shore Ranger Stations, lighthouses, fisheries, and certain cultural or archeological resources. Structures located outside these zones are protected (including life lease/fishery cabins), even though they are not explicitly located with a Suppression FMA.

Virtually all structures within the park (except campground privies and the three fire lookout towers) are found near shorelines, where it is reasonable to expect slow, creeping ground fires in these humid, cool settings. In most cases it is possible to protect structures by soaking them and the nearby forest vegetation with water pumped directly from Lake Superior. The suppression boundaries around these sites are flexible to allow for a range of responses to protect life and property from approaching fires.

All fires within the Suppression FMU are suppressed, regardless of fire origin. Appropriate holding actions are taken on wildland fires that originate outside the Suppression FMAs but threaten their boundaries. If holding actions are unsuccessful, wildland and prescribed fires that threaten to invade Suppression FMAs are declared "wildland fires managed with suppression actions" and appropriate suppression responses are taken to protect the values at risk within the unit(s).

Alternative 1 Fire Management Units



Wildland Fire Use Unit

About 95 percent of Isle Royale lies within the Wildland Fire Use Unit (formerly designated the "Prescribed Natural Fire Management Unit"). The unit's boundaries are designed to include all areas of the park except those that contain human developments or have continuous fuels contiguous to those developments. The objectives of this unit are to maximize the opportunities for fire to play its natural, crucial role in the ecosystem while fully protecting other values at risk.

In this FMU, most lightning-caused fires are allowed to burn under most weather conditions unless they threaten human life, property, or other critical resources. All wildland fires are monitored, re-evaluated, and approved daily.

Since appropriate suppression actions are taken on all human-caused wildland fires in this FMU (and all others), an attempt is made to rapidly establish the cause of all reported fires. All wildland fires are managed using a Wildland Fire Implementation Plan (WFIP) that documents the analysis and selection of strategies and describes the appropriate management response for the wildland fire. All fires that meet the requirements of wildland fire use are monitored daily or more often to determine fire size, location, rate of spread, intensity, and potential threats that might require suppression action.

WFU's that threaten natural or cultural resources (e.g. an active bald eagle nest or exposed archeological site) within this FMU are evaluated on a case-by-case basis and are subject to appropriate holding action. If necessary, naturally-ignited wildland fires are extinguished within this unit to avoid adverse impacts on irreplaceable resources.

Conditional Fire Management Unit

The objectives of the Conditional Fire Management Unit strike a balance between providing protection for life and property and perpetuating natural processes in backcountry areas of the park either adjacent to major developments or containing minor developments themselves. Ecologically, there is little or no difference between the Conditional FMU and the Wildland Fire Use FMU. The Conditional Unit, however, is located in areas where the risks of high-intensity or fast-moving fires outweigh their possible ecological benefits. Naturally-ignited wildland fires are allowed to burn within a prescription that is significantly more conservative than in the Wildland Fire Use Unit, allowing management to protect human life and/or property while still tolerating some degree of natural fire activity. In no case will decisions be made to deliberately threaten human life or property.

Conditional FMAs act as buffers around Suppression FMAs, and holding or suppression actions are undertaken as needed to prevent any fires burning in the Conditional FMU from escaping into the more conservative Suppression Unit. In contrast, fires burning from the Conditional Unit into the Wildland Fire Use Unit are allowed to burn as if no boundary existed. Naturally-ignited wildland fires originating in the Wildland Fire Use and burning

into the Conditional Unit are allowed to burn unimpeded only if they are within the more restrictive prescription of the Conditional Unit.

All fires that meet the more restrictive requirements of a naturally-ignited wildland fire within the Conditional FMU are monitored daily or more frequently to determine fire size, locations, rate of spread, intensity, and potential threats which might require holding or suppression action.

Under Alternative 1, prescribed fire (formerly designated "management-ignited prescribed fire") is used as appropriate to replace the ecological role of natural fire (in suppression and/or conditional FMUs), protect or restore critical plant or animal habitats or communities, eliminate exotic species, restore or maintain historic landscapes (e.g. Daisy Farm meadow), and/or reduce hazardous fuel conditions near developed areas. Compliance procedures with the National Historic Preservation Act (NHPA) are completed prior to implementation of a prescribed fire.

The objective of Isle Royale's prescribed fire program in most areas is to duplicate to the maximum extent possible the frequency and intensity of natural fires during times and in places where safety and control can be assured. In some vegetation/fuel types, however, low-intensity ground fires would have to be substituted for more intense fires that may have once destroyed whole stands of trees. This program would create and maintain a mosaic of burned and unburned areas that would approximate natural conditions.

Several historic sites in Isle Royale National Park were once more open and park-like than they are today; the Daisy Farm meadow is a case in point. While these areas were not necessarily created or maintained originally by fire, prescribed fires could be used to clear the encroaching vegetation and restore or maintain the open conditions of a particular historic period.

Similarly, hazardous fuel loads near developed areas can be reduced using prescribed fire, and these areas can be maintained in a low-fuel condition by its periodic application.

The prescribed fire aspect of wildland fire management in Isle Royale deals with the refined application of fire. The opportunity for skillful use of fire carries with it the liability of misuse. Park management is fully responsible for prescribed fires, and, given prudent safeguards, can foster their constructive use. Three safeguards are required to successfully implement a prescribed fire program in the park: (1) prescriptions and burn plans are written by qualified personnel; (2) prescriptions and burn plans are reviewed and approved by a designated person qualified to verify the proposal in regard to fire behavior, safety, and defined objectives; and (3) prescribed fires are conducted by a qualified Prescribed Burn Boss with go/no go decision authority.

The current, approved FMP allows for prescribed fires. However, as of 2002, the National Park Service has utilized this tool only on a very limited basis (Valencia, 2001). Thus, under Alternative 1, prescribed fires continue to be used very sparingly. The 1992 (current) FMP outlines the objectives and procedures necessary to implement a prescribed fire program, but emphasized that "implementation may not be immediate." Therefore, under Alternative 1, it is assumed that few prescribed fires are undertaken within the Wildland Fire Use FMU; even though

they are not expressly prohibited by the current, approved FMP, few have actually been conducted to date.

2.2 ALTERNATIVE 2 – MODIFIED NO ACTION *(PREFERRED ALTERNATIVE)*

This alternative, the NPS-preferred alternative, incorporates many elements of the existing, approved FMP, but includes modifications that will improve wildland fire and natural resources management in Isle Royale National Park.

Alternative 2 revises the park's existing Wildland Fire Management Plan to reflect recent NPS policy changes. Federal wildland fire policies in the areas of safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles are incorporated into the FMP. Alternative 2 complies with NPS Director's Order #18, Wildland Fire Management and the Federal Wildland Fire Management Policy national standards.

Under Alternative 2, fire management objectives are the same as under Alternative 1, but are re-ordered to give greater priority to the importance of protecting human life:

- **Protect human life, property, and irreplaceable natural and cultural resources from unwanted fire.**

- **To the extent possible given other objectives for protecting human life and property, allow fire to achieve its natural role in the ecosystem to perpetuate natural ecosystem processes.** This will assist in maintaining and restoring native wildlife species by maintaining a natural diversity of different kinds of plant communities. It will also limit opportunities for large, catastrophic fires, and disease and insect epidemics to spread by maintaining a representative natural mosaic of climax, sub-climax and seral forest vegetation of different ages.

- **Use prescribed fire to accomplish other specific resource management goals.** These goals may include the replacement of natural fire, protection or restoration of critical plant or animal habitats or communities, elimination of alien species, the restoration of historic scenes (e.g. Daisy Farm meadow), and/or the reduction in hazardous fuel conditions.

- **Minimize, and where necessary, mitigate unacceptable impacts of wildland fires and fire suppression.** This includes resource damage, aesthetic considerations, and waste of government funds.

- **Minimize unplanned human-caused ignitions.**

- **Promote public understanding of fire management programs and objectives.**
- **Integrate fire management with all other aspects of park management.**
- **Monitor and evaluate fire effects.**

Alternative 2 adopts the Canadian Fire Weather Indexes for fire danger rating and operational fire management decisions (in contrast to Alternative 1, which maintains the existing National Fire Danger Rating System).

In contrast to Alternative 1, Alternative 2 establishes just two FMUs at Isle Royale: Suppression and Wildland Fire Use. Areas within the Conditional FMU of Alternative 1 are absorbed either into the Suppression or Wildland Fire Use FMUs of Alternative 2. Figure 2.2-1 depicts Alternative 2's two FMUs and various Suppression FMAs.

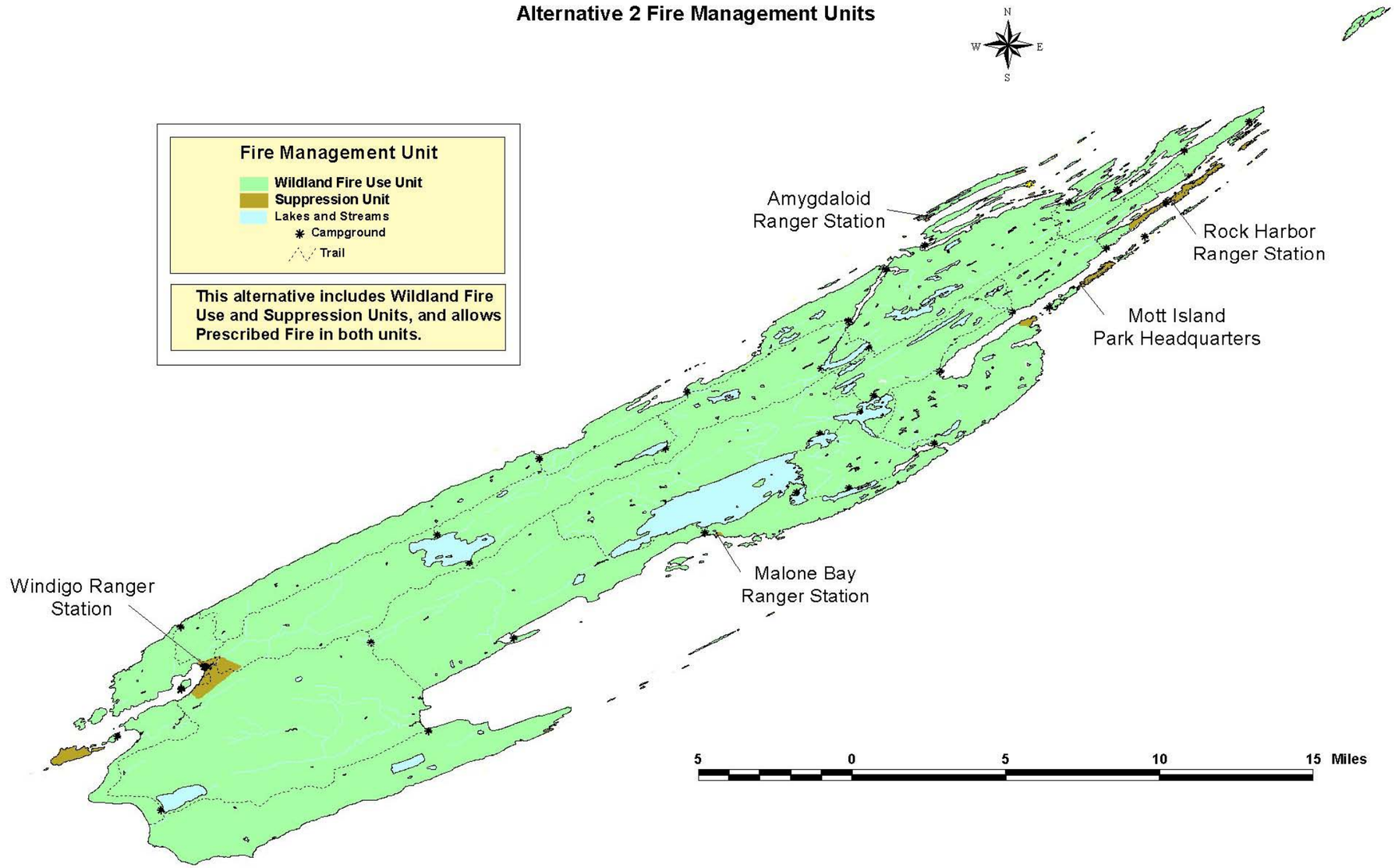
Suppression Unit

Under Alternative 2, Isle Royale's suppression unit includes several FMAs that provide protection for human life and property within the park's developed areas. The areas within the Suppression FMU have changed somewhat from Alternative 1 – they now include Mott Island and Davidson Island in their entirety, areas around the developments at Windigo, Rock Harbor, the North and South Shore Ranger Stations, lighthouses, some historic fishery locations, and several life lease cabins/islands in Tobin Harbor. Structures located outside these zones are protected (including life lease/fishery cabins), even though they are not explicitly located with a Suppression FMU. *All cultural resources originally in the Conditional or Suppression Unit from Alternative 1 receive protection, even though they are not explicitly located within the Suppression Unit.*

Virtually all structures within the park (except campground privies and the three fire lookout towers) are found near shorelines, where it is reasonable to expect slow, creeping ground fires in these humid, cool settings. In most cases it is possible to protect structures by soaking them and the nearby forest fuels with water pumped directly from Lake Superior. The suppression boundaries around these sites are flexible to allow for a range of responses to protect life and property from approaching fires.

All lightning and human-caused wildland fires originating from within or that threaten a Suppression FMU from outside are suppressed (managed) with the appropriate management response and analysis of the specific situation (WFSA). Mechanical fuel manipulation with power hand tools and prescribed fire is used to reduce fuels and accomplish vegetation management objectives within the Suppression FMU. The prescriptions used for prescribed fire within the park's Suppression FMU are narrower than those used for prescribed fire within the Wildland Fire Use FMU.

Alternative 2 Fire Management Units



Wildland Fire Use Unit

Under Alternative 2, the Wildland Fire Use Unit continues to occupy about 95 percent of the park's land area. The unit's boundaries are designed to include all areas of the park except those that contain human developments or have continuous fuels contiguous to those developments. The objectives of this unit are to maximize the opportunities for fire to play its natural, crucial role in the ecosystem while fully protecting other values at risk.

In this FMU, most lightning-caused fires are allowed to burn under most weather conditions unless they threaten human life, property, or other critical resources. All wildland fires are monitored, re-evaluated, and approved daily. Lightning ignitions that do not satisfy prescription criteria and ongoing wildland fire use fires that exceed prescription will be reclassified as unwanted wildland fires and an appropriate management response will be taken according to a Wildland Fire Situation Analysis (WFSA).

Since appropriate suppression actions are taken on all human-caused wildland fires in this FMU (and all others), an attempt is made to rapidly establish the cause of all reported fires. All wildland fires are managed using a WFIP that documents the analysis and selection of strategies and describes the appropriate management response for the wildland fire. All fires that meet the requirements of wildland fire use are monitored daily or more frequently to determine fire size, location, rate of spread, intensity, and potential threats that might require suppression action.

Wildland fires are managed with the appropriate management response as directed by Isle Royale's FMP and analysis of specific circumstances. These fires can be managed entirely or in any part for resource benefits or receive suppression actions to minimize burned area due to high values to be protected, threats to life or property, or other social, political, and economic considerations that outweigh potential environmental benefits. Managers will implement a decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives.

WFU's that threaten natural or cultural resources (e.g. an active bald eagle nest or exposed archeological site) within this FMU are evaluated on a case-by-case basis and are subject to appropriate holding action. If necessary, naturally-ignited wildland fires are extinguished within this unit to avoid adverse impacts on irreplaceable resources.

A key difference between Alternative 1 and Alternative 2 is that under Alternative 2, pending the outcome of ongoing research into the historic role of fire on Isle Royale, an active program of prescribed fire may be introduced into the Wildland Fire Use FMU. Under the current, approved FMP, even though prescribed fire is not explicitly excluded from this FMU, its use is not encouraged or emphasized. Alternative 2 encourages the application of prescribed fire in this FMU if the current investigation and review determine that it would be beneficial in restoring and rejuvenating desirable vegetation communities and wildlife habitat. Alternative 2 does not *mandate* the use of prescribed fire in the

Wildland Fire Use FMU, but rather provides the *flexibility* needed to utilize this tool if it is deemed beneficial.

When and if utilized in the Wildland Fire Use FMU, prescribed fire is restricted by a pre-determined set of parameters. Prescribed fires will only be ignited in designated prescribed fire units under specific prescriptions. A Prescribed Fire Plan is needed for all prescribed fires. Prescribed fires may be carried out at any time of the year when conditions are within prescription and operations will not conflict with control activities. When conditions are not within these parameters, fires initiated are suppressed or not used.

2.3 ALTERNATIVE 3 – COMPLETE SUPPRESSION OF ALL WILDLAND FIRES

This alternative involves suppressing all wildland fires (lightning-caused and human-caused fires) in Isle Royale National Park. Complete fire suppression was the policy of the entire National Park System and virtually all-federal agencies throughout most of the 20th century. This alternative also precludes the use of prescribed fire in the park.

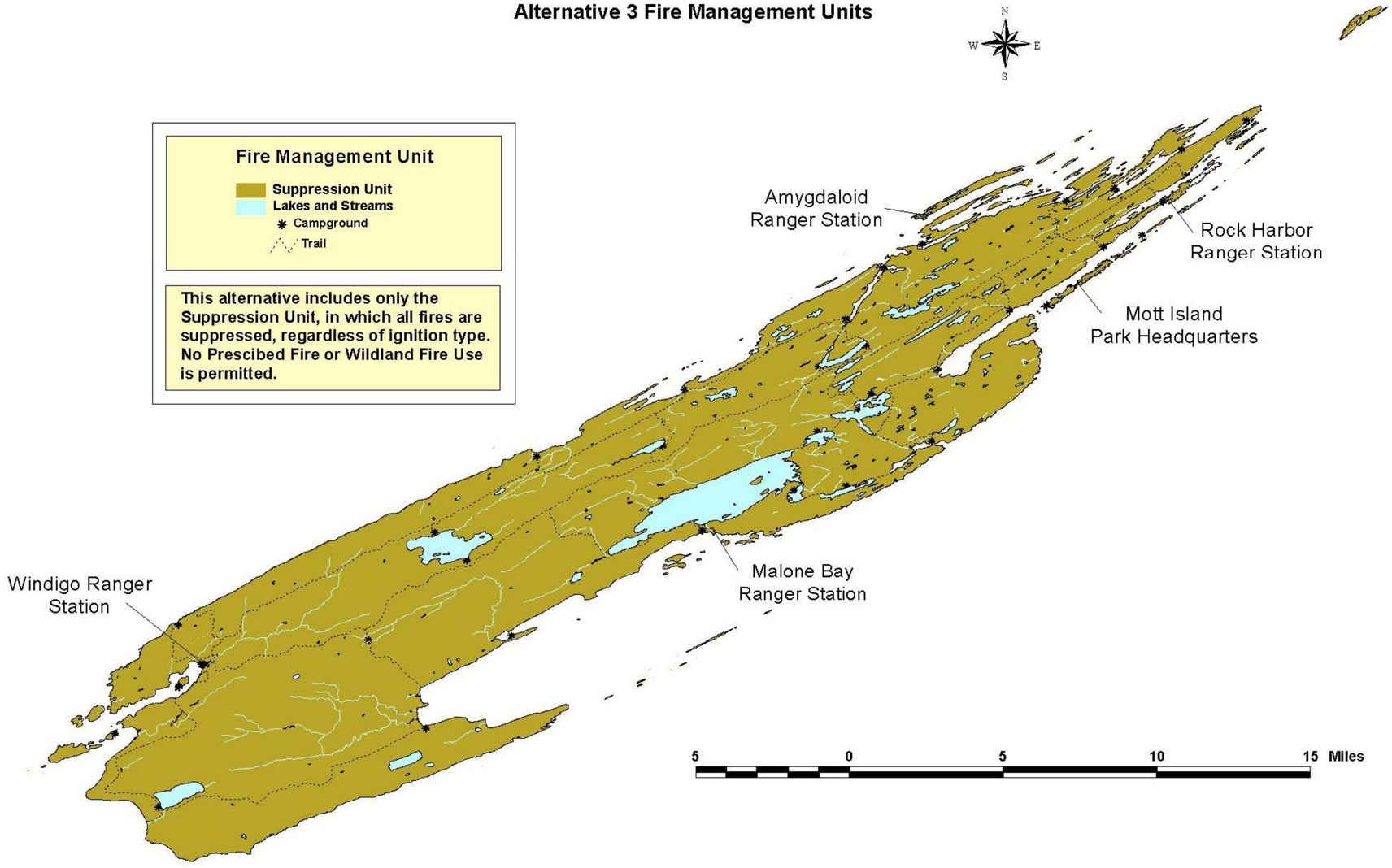
Alternative 3 revises the park's existing Wildland Fire Management Plan to reflect recent NPS policy changes. Federal wildland fire policies in the areas of safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles are incorporated into the FMP. The FMP complies with NPS Director's Order #18, Wildland Fire Management and the Federal Wildland Fire Management Policy national standards. Like Alternative 2, Alternative 3 adopts the Canadian Fire Weather Indexes for fire danger rating and operational fire management decisions.

In comparison to Alternative 1, the complete suppression of all wildland fires alternative emphasizes the goals of protecting life, property, and resources from unwanted fires and avoiding unacceptable effects of fires and fire suppression. However, an all-out effort to exclude fire from Isle Royale through a program of complete fire suppression and no use of prescribed fire may hinder pursuit of the park's purposes, which call for the preservation of ecological processes.

The ecological role of fire at Isle Royale is not a priority under this alternative. Nor is fire used proactively as a tool for vegetation or wildlife habitat management purposes. Forest stands in and adjacent to the park's developed areas are mechanically manipulated using power hand tools to reduce the fuel load and related fire hazard.

Under Alternative 3, a single Suppression FMU covers the entire park (see Figure 2.3-1). All lightning and human-caused wildland fires in Isle Royale National Park are suppressed (managed) with the appropriate management response and analysis of the specific situation (WFSA). In

Alternative 3 Fire Management Units



other respects, particularly with regard to fire management organization and responsibilities and wildfire mobilization, this alternative is very similar to the no action alternative.

This alternative results in accumulation of greater fuel loads over most of the park than in the no action alternative. When wildland fires do occur, especially under extreme weather conditions, they tend to be of a more severe and extensive in nature, and require a much greater effort at suppression. It is assumed that most unwanted wildland fires are successfully suppressed, but over the long term, a small number of very severe fires at infrequent intervals are a probability. This represents the natural fire regime in these (boreal and northern hardwood) forest types.

Under the complete suppression of all wildland fires alternative, fire monitoring and research still proceeds, public safety is still the highest priority, archeological and historical resources are protected to the extent feasible during firefighting efforts, and interagency consultation and coordination continues. Public information and educational efforts also continues, but they no longer emphasize the ecological value of fire, focusing rather on fire prevention.

Under Alternative 3, the following objectives guide fire management at Isle Royale:

- **Protect human life, property, and irreplaceable natural and cultural resources from unwanted fire.**

- **Minimize, and where necessary, mitigate unacceptable impacts of wildland fires and fire suppression.** This includes resource damage, aesthetic considerations, and waste of government funds.

- **Avoid unplanned human-caused ignitions.**

- **Promote public understanding of fire management programs and objectives.**

- **Integrate fire management with all other aspects of park management.**

- **Monitor and evaluate fire effects.**

2.4 ALTERNATIVE 4 – EMPHASIZE WILDLAND FIRE USE AND EXCLUDE PRESCRIBED FIRE

In keeping with one of Isle Royale National Park's original purposes – that of preserving ecological processes – this alternative allows natural processes to determine the fate of all lightning-caused fires at any time of year, except for those posing imminent threats to human life, developed facilities or private property. The philosophy underlying this alternative is to minimize human intervention in the natural processes occurring on the park's wildlands, 99 percent of which are designated as Wilderness under the 1964 Wilderness Act. This alternative also eliminates prescribed fire throughout the park. In the Suppression Units, only mechanical

means (power hand tools) are used to achieve hazard fuel reduction in the vicinity of developed areas.

This alternative revises the park's existing Wildland Fire Management Plan to reflect recent NPS policy changes. Federal wildland fire policies in the areas of safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles are incorporated into the FMP. Alternative 4 complies with NPS Director's Order #18, Wildland Fire Management and the Federal Wildland Fire Management Policy national standards.

The net effect of this alternative is to expand the existing the Wildland Fire Use FMU in Alternative 1 over all but the Suppression FMU (see Figure 2.4-1). The Conditional FMU of Alternative 1 is eliminated from this alternative, as it also is in Alternative 2. The Suppression FMAs are the same in Alterative 4 as in Alternative 2. No prescribed fires are conducted within the Wildland Fire Use FMU.

Under Alternative 4, fire management objectives are similar to those of Alternative 2, except that the reference to using prescribed fire has been eliminated, to wit:

- **Protect human life, property, and irreplaceable natural and cultural resources from unwanted fire.**

- **To the extent possible given other objectives for protecting human life and property, allow fire to achieve its natural role in the ecosystem to perpetuate natural ecosystem processes.** This will assist in maintaining and restoring native wildlife species by maintaining a natural diversity of different kinds of plant communities. It will also limit opportunities for large, catastrophic fires, and disease and insect epidemics to spread by maintaining a representative natural mosaic of climax, sub-climax and seral forest vegetation of different ages.

- **Minimize, and where necessary, mitigate unacceptable impacts of wildland fires and fire suppression.** This includes resource damage, aesthetic considerations, and waste of government funds.

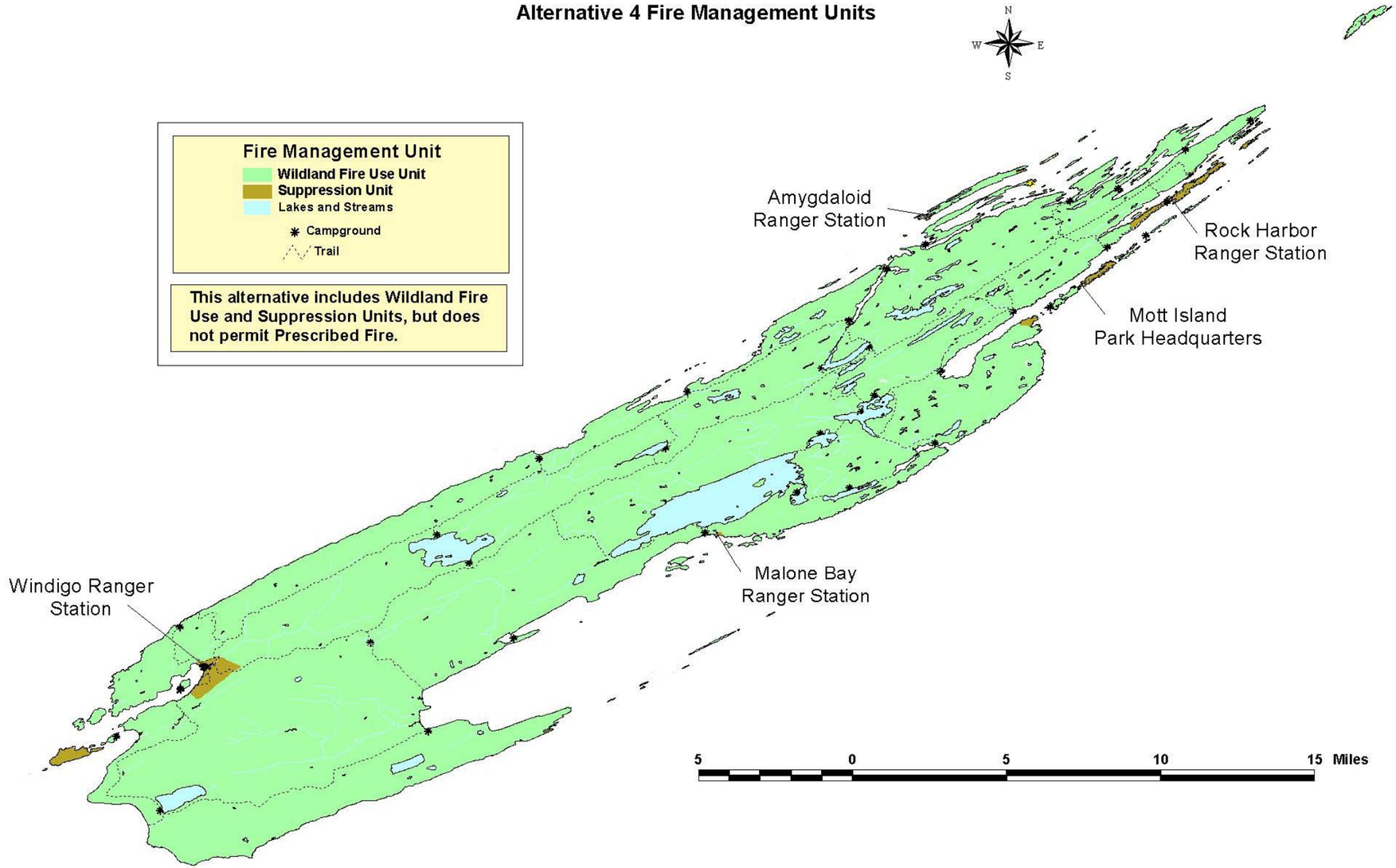
- **Avoid unplanned human-caused ignitions.**

- **Promote public understanding of fire management programs and objectives.**

- **Integrate fire management with all other aspects of park management.**

- **Monitor and evaluate fire effects.**

Alternative 4 Fire Management Units



Like Alternative 2, Alternative 4 also adopts the Canadian Fire Weather Indexes for fire danger rating and operational fire management decisions (in contrast to Alternative 1, which maintains the existing National Fire Danger Rating System).

There are two FMUs under Alternative 4: 1) Suppression, and 2) Wildland Fire Use.

Suppression Unit

In Alternative 4, Isle Royale's suppression unit includes several FMAs that provide protection for human life and property within the park's developed areas. These include Mott Island and Davidson Island in their entirety, areas around the developments at Windigo, Rock Harbor, the North and South Shore Ranger Stations, lighthouses, some historic fishery locations, and several life lease cabins/islands in Tobin Harbor. Structures located outside these zones are protected (including life lease/fishery cabins), even though they are not explicitly located with the Suppression FMU. *All cultural resources originally in the Conditional or Suppression Unit from Alternative 1 will receive protection, even though they are not explicitly located within the Suppression Unit.*

Virtually all structures within the park (except campground privies and the three fire lookout towers) are found near shorelines, where it is reasonable to expect slow, creeping ground fires in these humid, cool settings. In most cases it is possible to protect structures by soaking them and the nearby forest fuels with water pumped directly from Lake Superior. The suppression boundaries around these sites are flexible to allow for a range of responses to protect life and property from approaching fires.

All fires within the Suppression FMU are suppressed, regardless of fire origin. Appropriate holding actions are taken on wildland fires that originate outside Suppression FMAs but threaten their boundaries. If holding actions are unsuccessful, wildland fires that threaten to invade Suppression FMAs are declared "wildland fires managed with suppression actions" and appropriate suppression responses are taken to protect the values at risk within the area(s).

Wildland Fire Use Unit

In Alternative 4, the Wildland Fire Use Unit includes every area that it does under Alternatives 1 and 2, and it also absorbs most of the Conditional Unit in Alternative 1.

This unit's boundaries are designed to include all areas of the park except those that contain human developments. The objectives of this unit are to maximize the opportunities for fire to play its natural, crucial role in the ecosystem while fully protecting other values at risk.

In this FMU, most lightning-caused fires are allowed to burn under most weather conditions unless they threaten human life, property, or other critical resources. All wildland fire use fires are monitored, re-evaluated, and approved daily.

Since the appropriate management actions may differ on human-caused wildland fires in this (and all other) FMUs, an attempt is made to rapidly establish the cause of all reported fires. All wildland fires are managed using a WFIP that documents the analysis and selection of strategies and describes the appropriate management response for the wildland fire. All fires that meet the requirements of wildland fire use are monitored daily or more frequently to determine fire size, location, rate of spread, intensity, and potential threats that might require suppression action.

Fires that threaten natural or cultural resources (e.g. an active bald eagle nest or exposed archeological site) from wildland fire use within this FMU are evaluated on a case-by-case basis and are subject to appropriate holding action. If necessary, naturally-ignited wildland fires are extinguished within this unit to avoid adverse impacts on irreplaceable resources.

Unlike the Wildland Fire Use units of Alternatives 1 and 2, there will be no prescribed fire in the WFU unit of Alternative 4.

2.5 ALTERNATIVE 5 – EMPHASIZE PRESCRIBED FIRE AND EXCLUDE WILDLAND FIRE USE

Alternative 5 revises the park's existing FMP to reflect recent NPS policy changes. Federal wildland fire policies in the areas of safety, planning, wildland fire, prescribed fire, preparedness, suppression, prevention, protection priorities, interagency cooperation, standardization, economic efficiency, wildland/urban interface, and administration and employee roles are incorporated into the FMP. Alternative 5 complies with NPS Director's Order #18, Wildland Fire Management and the Federal Wildland Fire Management Policy national standards.

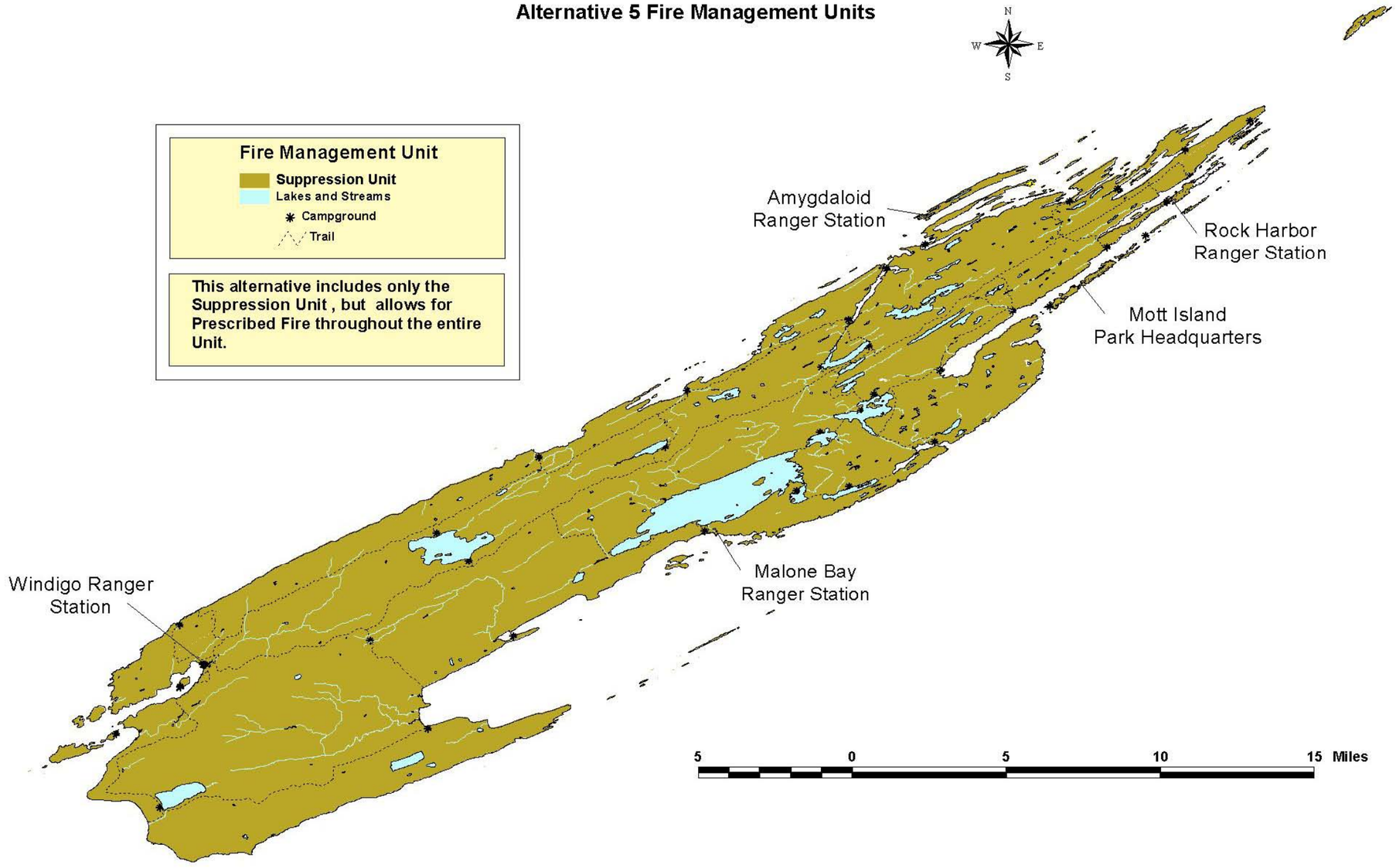
This alternative uses prescribed fire as the preferred tool for managing habitat and protecting life and property at Isle Royale, while completely excluding wildland fire use. The net effect of this alternative is to expand the Suppression FMU over the entire park (see Figure 2.5-1). All wildland fires are suppressed within the Suppression FMU, but prescribed fires are permitted and used regularly. The Conditional FMU of Alternative 1 is eliminated from this alternative.

Under Alternative 5, fire management objectives are similar to those of Alternative 2, except that the second objective of allowing “fire to achieve its natural role in the ecosystem” has been eliminated, and the prescribed fire objective given greater prominence:

- **Protect human life, property, and irreplaceable natural and cultural resources from unwanted fire.**

- **Use prescribed fire to accomplish specific resource management goals.** These goals may include the replacement of natural fire, protection or restoration of critical plant or animal habitats or communities, elimination of alien species, the restoration of historic scenes (e.g. Daisy Farm meadow), and/or the reduction in hazardous fuel conditions.

Alternative 5 Fire Management Units



- **Minimize, and where necessary, mitigate unacceptable impacts of wildland fires and fire suppression.** This includes resource damage, aesthetic considerations, and waste of government funds.

- **Avoid unplanned human-caused ignitions.**

- **Promote public understanding of fire management programs and objectives.**

- **Integrate fire management with all other aspects of park management.**

- **Monitor and evaluate fire effects.**

Prescribed fire is utilized according to a pre-determined set of parameters. Prescribed fires can be ignited in designated prescribed fire units under specific prescriptions. They may be carried out at any time of the year when conditions are within prescription and operations would not conflict with control activities. When conditions are not within these parameters, fires initiated are suppressed or not used. Priorities for use of prescribed fires are determined by the length of time since previous burn, current fuel loading and vegetative conditions, habitat management concerns, topographic advantage, and by personnel and logistical requirements.

2.6 ENVIRONMENTALLY PREFERRED ALTERNATIVE

The National Park Service is required to identify the environmentally preferred alternative(s) for any of its proposed projects. That alternative is the alternative that will promote the national environmental policy expressed in NEPA (Section 101 (b)). This includes alternatives that:

1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2) ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In essence, the environmentally preferred alternative would be the one(s) that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (NPS, 2001).

In this case, the Preferred Alternative (#2 – Modified No Action) is the environmentally preferred alternative for the new and revised Fire Management Plan for Isle Royale National Park, since it comes the closest to meeting goals 1, 2, 3, 4 and 6 above. Under this alternative, a combination of 1) expanded prescriptions for wildland fire use, 2) prescribed fires (also under expanded prescription) for habitat management and hazard fuel reduction, as well as 3) fire suppression, will all be used to protect human life and property, reduce hazardous fuel loadings in the park, simulate natural ecological processes, maintain a representative natural mosaic of climax, sub-climax and seral forest vegetation of different ages, and improve wildlife habitat. Finally, this alternative best protects and helps preserve the historic, cultural, and natural resources in the park for current and future generations.

2.7 MITIGATION MEASURES COMMON TO EACH ALTERNATIVE

A number of mitigation measures are common to each alternative. These are listed below under resource area:

Soils

Minimum Impact Suppression Tactics (MIST) will be used in all fire suppression activity. MIST relevant to protecting soils include the following:

- Cold trail the fire-edge when practical.
- Wetlines, or environmental lines, will be used wherever possible in lieu of handline construction if water and pumps are available. Waterbars will be constructed on handlines on steep slopes.
- Utilize soaker hose or foggers in mop-up. Avoid "boring" and hydraulic action on shallow soils.
- Firelines will be kept to the minimum width necessary to allow backfiring or safe blackline to be created. Utilize natural barriers wherever possible to avoid "tunnel effect."
- If a mineral soil line is needed, utilize fireline explosives whenever possible.

Water Resources

The following special restrictions apply to aerially-applied retardant and different types of foam suppressant use:

Retardant – No retardant drops within 400 feet of open water.

Foam (aerial delivery) – Aerial delivery of foam requires Park Superintendent approval on a case-by-case basis. When approved, the following guidelines apply:

- Foam concentrate will only be injected into the holding tank after the water pick-up operation has been completed.
- Drops from Beaver, T2 & T3 helicopters – no drops within 200 feet of open water.
- Drops from Scoopers, heavy air tanker or heavy helicopter – no drops within 400 feet of open water.

Foam (ground delivery with motorized pumps):

- No application within 25 feet of open water when using small pumps.
- No application within 50 feet of open water when using Mk III or equivalent pumps.
- All foam concentrate used for injection will be located in impermeable containment basins, i.e. visqueen (plastic sheet) spread over rocks or logs to form a catch basin.

Foam (ground delivery with backpack pumps):

- No application within 10 feet of open water.
- All backpack pumps will be filled a minimum of 10 feet from open water. A separate, uncontaminated container must be used to transport water from source to backpack pump. This container must be kept uncontaminated by concentrate.

Air Quality

1. Notification Procedures

   a. Wildland fires managed with suppression actions: no notification of Michigan Department of Natural Resources (MDNR) required

   b. Prescribed fires: no notification of MDNR required

   c. NPS will contact the Michigan Department of Environmental Quality Air Quality District Supervisor in Marquette, Michigan if a fire use fire or unwanted wildland fire

is of sufficient size or smoke generation resulting in health concerns to the public, nuisance complaints, or media interest.

2. Smoke-Sensitive Targets

Management needs to recognize areas where smoke problems are likely and take steps to notify visitors and/or mitigate the smoke intrusion. At Isle Royale, the notification process will be part of the public information and interpretation program outlined in Section X of the FMP. Information on the objectives of the park fire management program will be explained to visitors and residents exposed to smoke discomfort from any fires.

Smoke management guidelines produced by the U.S. Forest Service recommend identifying all sensitive areas downwind of and within 10 miles for backing fires, 20 miles of head fires or large burns (over 250 acres), or 30 miles for logging debris or slash fires. Since there are no logging operations at Isle Royale, only targets within 20 miles will be identified. Grand Portage, Minnesota is the only mainland community within 20 miles of any part of Isle Royale, and it just barely meets that standard.

3. Other Mitigation Strategies

a. Planned prescribed fires and WFU's – Fires to improve resource values will have a smoke dispersion component in the prescription. If smoke creates a prolonged hazard or significant nuisance, appropriate actions will be taken to mitigate the condition causing the problem or the fire will be suppressed.

b. Suppression – Suppress or mop up smoldering fuels when they are likely to generate smoke management "problems."

c. Ignition – Ignite smoldering fuels to get them to burn with an active flame, which generates less than half the emissions than smoldering combustion. Flaming combustion also generates convection columns, which raise smoke above ground level.

d. Types of Fires – Use backing fires when possible.

e. Dispersion – Recognize poor dispersion conditions that will last several days, such as the predicted passage of a slow-moving warm front; a lingering high pressure system with stable atmosphere; or high humidity conditions, and adjust burning strategies as necessary.

f. Residual Smoke – When a fire has burned for an extended period of time and generated a lot of residual smoke, the NPS will consider suppressing all new starts to minimize additional smoke production.

g. Firefighter Safety – During high smoke production phases of a fire suppression operation, crews will be rotated out of high smoke areas.

h. Sensitive Areas – Planned prescribed fire ignitions in sensitive areas will be done either when visitation is low, or the Superintendent will restrict entry to areas potentially impacted by smoke.

4. Air Quality and Smoke Monitoring

The Incident Commander (IC) or Prescribed Burn Boss (RXB1/2) is responsible for monitoring weather and smoke dispersion conditions and forecasts, and taking appropriate action.

No special quantitative smoke or emissions monitoring is possible beyond the normal air quality monitoring instruments in the park. Unfortunately, these do not provide useful real-time data for fire management purposes. Unusual or adverse smoke conditions will be documented by the Incident Commander or Prescribed Burn Boss in the fire log (and with photographs when possible). District Rangers will be responsible for alerting the IC or PBB of impending or actual smoke problems in their districts.

In extraordinary circumstances, portable air quality monitoring equipment may be available from the MDNR or the NPS Air Quality Division.

Threatened and Endangered Species

- All active bald eagle nests, gray wolf den locations, sensitive plant locations, or any other listed species known to be present, which fall within or in close proximity to prescribed fires or wildland fires, will receive mitigation to ensure they are not impacted. If circumstances arise where a wildland fire poses a threat to an active bald eagle nest or known active wolf den, emergency consultation will occur with the U.S. Fish and Wildlife Service to consider potential mitigation actions to reduce impacts to the affected species. Specific mitigation actions that address specific circumstances and concerns will be included in individual implementation plans. These implementation plans are Prescribed Burn Plans for prescribed burns, Wildland Fire Implementations Plans (WFIPs) for WFU fires, and Incident Action Plans for suppression actions. Specific mitigation measures will be tailored to respond to the particulars of each situation. Generally, prescribed fires will not be used when conditions would result in smoke enveloping an active eagle nest, and overall, the use of prescribed fire will be consistent with protective buffer zones described in the Northern States Bald Eagle Recovery Plan.

- No prescribed fires will be conducted within one-half mile of known or traditional wolf den sites prior to July 1.

- Fire management staff will provide Chief, Ranger Activities and Resource Management with prescribed fire plans far enough in advance to allow survey of the area.

- Fire management staff will inform Chief, Ranger Activities and Resource Management of unwanted wildland fire's suppression activities as soon as possible.

- If a fire is judged to threaten an active eagle's nest, and mitigation measures would not be effective, that fire will be suppressed.

Wilderness

- Minimum Impact Suppression Tactics (MIST) will be used in all fire suppression activity within recommended wilderness areas.

Noise

- To reduce noise impacts from overflights or other equipment on sensitive species such as the currently-threatened bald eagle, the Fire Management Coordinator will work with park Natural Resource staff to determine unit-specific mitigation measures in the operational plans for the fire activity. Operational plans include Wildland Fire Implementation Plan for wildland fire use fires, prescribed fire plans, or incident action plans for suppression activities. Active bald eagle nests will be avoided entirely if possible. If it is determined that using aircraft in the vicinity of nesting bald eagles is necessary, takeoffs and landings will be avoided within 1/4 mile (0.4 km) of the nest. Under no circumstances shall aircraft be within 500 feet (150 m) of a nest. Recurring activity (passes, circling, hovering) will remain 1,500 feet (450 m) or more above ground level. Noise impacts will be evaluated as park managers determine the "Appropriate Management Response" for a fire.

- Fuel treatments near the campgrounds and developed areas will be restricted to times of low visitor use of the park to minimize and/or eliminate noise impacts on recreationists and visitors.

Cultural Resources

Fire management staff will keep Isle Royale's Branch Chief, Cultural Resources informed as to upcoming prescribed fire and suppression activities. NHPA-related compliance with be completed prior to any prescribed fire activities. During fire suppression, prescribed fire, and rehabilitation activities, the following measures will be undertaken to help mitigate the impacts of fire suppression and rehabilitation on cultural resources:

- Once they are developed, resource base maps showing archeological, ethnographic, and historical site locations will be given to archeologists and fire bosses on the firelines.

- When known archeological sites are threatened by a fire, archeologists will be present to help mitigate the impacts of fire suppression and rehabilitation on the archeological resources. When known ethnographic sites are threatened, a qualified ethnographer will be consulted or brought on site to help mitigate the impacts on ethnographic resources.

- Archeologists serving on a fire as technical specialists do not have to hold a current red card to perform their specific advisory duties.

- Line archeologists will be equipped with appropriate standard firefighting safety equipment.

- Special flagging will be used to identify archeological, ethnographic, and historical sites.

- A photographic record will be kept of all archeological materials uncovered during fire management and rehabilitation activities. In addition, accurate maps will be prepared, plus comprehensive site data including soil type and depth at which artifacts were found.

- The Branch Chief, Cultural Resources will coordinate all activities of line archeologists with fire bosses.

- An archeologist will be on site any time fireline construction or any ground breaking activities are taking place in a known archeological site.

- At a minimum, a paraprofessional archeologist will be present for fireline construction or any ground breaking activities in an unsurveyed location.

Public Safety

1. Closures

a. Areas identified as high risk may be closed when the risk to visitors, life lessees, special use permittees, and residents is deemed unacceptable. If potential hazards exist at campgrounds and other developed areas, these may remain closed until all hazard trees are felled or removed from the vicinity of the site.

b. When the hazards from a wildland fire or dense smoke are high, signs near the hazard area may be posted. Trails, campgrounds, docks, and backcountry zones may be closed if deemed necessary by the Incident Commander and as approved by the Superintendent. District Rangers will insure that closure and/or informational signs are properly posted and that boaters are made aware of smoke hazards on waterways. If boating conditions deteriorate due to smoke, the park dispatcher will advise the Coast Guard and mariners via marine radio broadcasts.

c. Visitor use may be limited or prevented near wildland fires and potentially affected areas. NPS personnel will patrol the perimeter of fires burning near visitor use areas to inform visitors about the role of fire in a natural area, explain the risks associated with approaching too close to a fire, and enforce visitor compliance with area closure orders.

2. Protection – Any time human life is endangered, all necessary means will be taken to warn or evacuate visitors, life lessees, special use permittees, and residents. District Rangers and/or initial attack/monitoring/burn team members will determine the proximity of visitors, life lessees, special use permittees, and residents to the fire, inform them of potential hazards, and aid in their evacuation if necessary.

3. Communication

a. Signs notifying the public about ongoing fires, area closures, dense smoke, or other special situations will be placed in appropriate places.

b. When a wildland fire is in progress for more than one burning period, information listing location, behavior, expected dangers, areas to avoid, and precautions to be taken will be posted at park information stations, posted on the Isle Royale website, and distributed to life lessees and special use permittees in the vicinity. Information signs or fliers will be developed by the Branch Chief, Interpretation after consultation with the Incident Commander and Fire Management Coordinator, and will be posted by District Rangers. Interpreters will be utilized to inform the public of dangers as well as interpret either the role of fire in natural areas (for management fires) or the nature of the fire suppression effort.

c. Information about burned areas will be posted at information stations, trailheads, and/or campgrounds if potential hazards exist. Trails, campgrounds, and backcountry zones will remain closed until mitigation measures have been completed. The public will be informed of hazards and appropriate safety precautions associated with traveling through or camping in burned areas.

Visitor Use and Experience

Many of the above measures (especially related to smoke and safety) will mitigate the impacts of the fire management program on visitor use and experience. In addition, Isle Royale will undertake an information and education program. The guidelines below will be followed:

1. Involved NPS Personnel – The Chief, Ranger Activities and Resource Management, and the Interpretive Specialist (Public Information Officer) will be kept informed daily by the Fire Management Coordinator of management actions, and the status of fires in the park.

2. Ecological Information – Ecological concepts upon which the wildland fire management program is based will be incorporated into information handouts, selected books written about the park, and wayside and visitor center exhibits. Fliers and brochures explaining the fire management program will be available for visitors. During periods when prescribed fires are burning, these handouts will be actively distributed to visitors at park information stations.

3. Interpretive Programs – The fire management program will be incorporated into appropriate interpretative programs, printed materials, and wayside and visitor center exhibits. Particular attention will be given to these activities when active fires are conspicuous or when the national fire situation is in the news.

4. Media Information – During ongoing fires, news articles will be written and released to local media.

5. Employee Awareness – To effectively answer visitor questions, every NPS employee in the park will be made aware of the wildland fire management program during training. The status of ongoing fires will be available via park radio broadcasts.

6. Cooperative Association – The Isle Royale Natural History Association will make relevant, factually accurate, publications that address fire's role in natural areas available to visitors at its sale outlets.

7. Informal Contacts – The wildland fire management program will be discussed in informal contacts with all divisions, park concessionaires, special use permittees, park neighbors, and park visitors.

Step-up Activities

During periods of Very High or Extreme fire danger – Staffing Classes 4 and 5 (SC4 and SC5) – additional information activities will be used to inform the visiting public, lessees, concession personnel and residents of fire risks, particularly in the backcountry.

1. Signing – Signs notifying the public about ongoing fires, area closures, dense smoke, or other special situations will be placed in appropriate places.

2. Contacts – When fire danger ratings indicate a SC 4 or 5 information listing expected dangers, areas to avoid, and precautions to be taken will be posted at park information stations and distributed to life lessees and special use permittees in the vicinity. Information signs or fliers will be developed by the Interpretive Specialist after consultation with the Fire Management Coordinator, and will be posted by District Rangers.

3. Closures – Visitor use may be restricted or prevented during extended high fire danger conditions. NPS personnel will patrol closed areas to enforce visitor compliance with area closure orders.

4. Cooperator/Concession Contacts – The Fire Management Coordinator will inform park concessionaires, and the Area Fire Management Officer about Very High or Extreme fire danger in the park. The Fire Management Coordinator or designee will notify MNICS agencies of Very High to Extreme fire danger by completing and submitting the MNICS Situation Report.

2.8 COMPARISON OF ALTERNATIVES

Table 2.8-1 on the next page compares the potential environmental impacts resulting from the five alternatives. Potential impacts are grouped according to environmental resource area or component. Section 4.0, Environmental Consequences, of this EA contains a detailed discussion of these potential impacts by resource area.

Table 2.8-1. Comparison of Potential Impacts of the Alternatives*					
Environmental Resource/ Component	**Alternative 1 – No Action / Implement 1992 FMP**	**Alternative 2 – Modified No Action *(Preferred Alternative)***	**Alternative 3 – Complete Suppression of All Wildland Fires**	**Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire**	**Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use**
Soils	Negligible on geology Long-term, localized and minor on soils	Negligible on geology Long-term, localized and minor on soils	Negligible on geology Long-term, potentially regional, moderate on soils	Negligible on geology Long-term, potentially regional, moderate on soils	Negligible on geology Long-term, localized and minor on soils
Water Resources	Long-term, localized and minor	Long-term, localized and minor	Long-term, localized and minor (most years) Short-term, regional, and moderate to major (infrequently)	Long-term, localized to regional, and minor to moderate	Long-term, localized and negligible to minor
Floodplains and Wetlands	Negligible to minor	Negligible to minor	Negligible (most years) Minor (infrequently)	Negligible to minor	Negligible to minor
Air Quality	Short-term, regional and minor to moderate	Short-term, regional and minor to moderate	Temporary, localized and minor (most years) Temporary, regional and major (infrequently)	Short-term, regional and minor	Short-term, regional and minor to moderate
Vegetation	Long-term, regional, and minor adverse	Long-term, regional, and probably moderately beneficial	Long-term, regional, and moderately adverse	Long-term, regional, and minor adverse	Long-term, regional, and probably moderately beneficial
Wildlife and Fisheries	Long-term, regional, and minor beneficial to minor adverse on wildlife Negligible on fisheries	Long-term, regional and moderately beneficial on wildlife Negligible on fisheries	Long-term, regional, and moderately to major adverse on wildlife Negligible on fisheries	Long-term, regional, and minor beneficial to minor adverse on wildlife Negligible on fisheries	Long-term, regional and moderately beneficial on wildlife Negligible on fisheries

Threatened and Endangered Species	Long-term, regional, minor adverse	Long-term, regional, minor beneficial	Long-term, regional, and minor to moderately adverse	Long-term, regional, minor adverse	Long-term, regional, minor beneficial
Wilderness	Negligible to minor adverse	Negligible adverse	Minor adverse	Negligible adverse	Negligible to minor adverse
Noise	Temporary, localized, negligible to minor	Temporary, localized, negligible to minor	Temporary, localized, negligible to minor	Temporary, localized, negligible to minor	Temporary, localized, negligible to minor
Cultural Resources	Long-term, regional, and negligible to minor adverse	Long-term, regional, and negligible to minor adverse	Long-term, regional, and negligible to minor adverse	Long-term, regional, and negligible to minor adverse	Long-term, regional, and negligible to minor adverse
Social and Economic Environment (Human Health and Safety)	Long-term, regional, and moderately beneficial	Long-term, regional, and moderately beneficial	Long-term, regional, and moderately beneficial (most years); moderate to major adverse impacts (infrequently)	Long-term, regional, and moderately beneficial (most years); minor to moderate adverse impacts (infrequently)	Short-term minor adverse impacts: long-term, regional, and moderately beneficial
Park Facilities & Operations/ Visitor Use * Experience	Short-term, localized and negligible on facilities Short-term, localized and negligible to minor on operations Long-term, regional, and minor adverse on visitor use & experience	Short-term, localized and negligible on facilities Short-term, localized and negligible to minor on operations Long-term, regional and minor to moderate on visitor use & experience	Short-term, localized and negligible on facilities Short-term, localized and negligible to minor on operations Temporary, localized and minor on visitor use & experience (most years) Moderate to major impacts on facilities, operations and visitor use & experience during infrequent, extreme fire years	Short-term, localized and negligible on facilities Short-term, localized and negligible to minor on operations Long-term, regional and minor to moderate on visitor use & experience	Short-term, localized and negligible on facilities Short-term, localized and negligible to minor on operations Long-term, regional and minor to moderate on visitor use & experience

* See Section 4.1 for definitions of terms used in this table.

Chapter 3
AFFECTED ENVIRONMENT

This chapter provides a discussion of those resource areas that may be affected by the FMP alternatives. The resources considered in this analysis include soils, water resources, floodplains and wetlands, air quality, vegetation, wildlife and fisheries, threatened and endangered species, wilderness, noise, cultural resources, human health and safety, park facilities & operations, and visitor use & experience.

3.1 NATURAL RESOURCES

3.1.1 Introduction

Isle Royale National Park (Isle Royale) is a forested archipelago surrounded by the deep, cold waters of the largest of the Great Lakes (NPS, 1998). The park is located in the northwestern section of Lake Superior, within 14 miles of the Ontario (Canada) shoreline and within 18 miles of Minnesota, but approximately 60 miles from Michigan's Upper Peninsula. The park consists of the main island – Isle Royale itself, which is 45 miles long and up to nine miles wide – and about 400 smaller islands. Its boundary extends 4.5 miles into Lake Superior, except where the nearby U.S.-Canadian border comes closer. The national park's total area is 571,796 acres, divided between 133,788 acres of land, and 438,008 acres of surrounding Lake Superior waters. Approximately 200 inland lakes and ponds are scattered across Isle Royale, as are numerous bogs and marshes.

The main island contains a series of parallel ridges and valleys and a shoreline marked by numerous islands, narrow peninsulas, and bays. Ridges run southwest-northeast, generally with moderate slopes on the southeast aspect and steep slopes or cliffs on the northwest side. The highest point in the park is 1394 feet above sea level, almost 800 feet above Lake Superior (NPS, 1998).

Detailed data of historical weather patterns at Isle Royale are scanty. Generally speaking, the climate of the park, strongly affected by Lake Superior, is characterized by short, cool summers and long, cold winters. Due to the moderating influence of the lake, summers are cooler and winters are warmer than the nearby mainland. Precipitation falls year-round, mostly as rainfall, averaging approximately 30 inches per year (ISRO, 1999). Snow typically accumulates from mid-November through April. Fog is frequent near the lakeshore, especially in the spring. At night, relative humidities normally return to high levels over most of the park, although ridgetop humidities usually recover less. The lake influence reverses the pattern seen in most places where temperatures fall and humidities rise with elevation; at Isle Royale this "marine inversion" means that lakeshore environments are cool and humid, and inland, higher elevation areas are warmer and drier. As would be expected, winds are usually higher on the exposed ridges, and south or southeast aspects are exposed to long hours of summer sun at the park's 48E north-latitude.

During the summer, regional or synoptic weather patterns influence Isle Royale's fire environment, though the lake effect often moderates this influence. Persistent, dry high-pressure systems can dry out fuels, and then when air masses begin to change, the situation can turn dangerous. Peak fire danger is expected when the Lake States have been under extended high-pressure influence just before the passage of a cold front. The 1936 fire, the largest since the park began keeping records, began in the same month as the all-time highest recorded temperature in Michigan (112E F). The 1988 Stanley Fire, the third largest recorded in the park, occurred during the hottest summer of the decade (NPS, 1992).

Isle Royale is located in a zone of transition, or ecotone, between two major North American ecosystems or biomes – the boreal forest and northern hardwood forest. Boreal forest vegetation dominates the northeastern part of the island; here forest vegetation is strongly influenced by lake effect climate, shallow soils, and windthrow. Northern hardwoods are more dominant in Isle Royale's southwestern portion, where soils are deeper and lake effect climate is not as influential.

Isle Royale's wildlife includes a number of North Woods species, but its biodiversity (except for birds) is generally lower than that of the mainland because the islands' isolation has restricted migration to them from outside populations of terrestrial organisms. In addition, the limited land area of the archipelago likely impedes the long-term survival of viable populations of larger organisms with larger home ranges or territories (ISRO, 1999). Isle Royale is thus a fascinating case study testing theories of island biogeography that attempt to explain lower species numbers (particularly mammals) and genetic change in some taxa (like fish) due to long-term isolation from other populations (MacArthur and Wilson, 1967). Wolf and moose populations, although together on the island only since the late 1940's, have become a classic study in predator/prey relationships; they have also come to represent the wilderness character of Isle Royale to the American public.

Congress recognized Isle Royale National Park's wilderness essence in 1976 when it designated 131,880 acres of Isle Royale's land area, about 99 percent of it, as Wilderness (NPS, 1998), that is, as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (The Wilderness Act, September 3, 1964; (16 U.S.C. 1121 (note), 1131-1136)).

Further acknowledgement of its outstanding natural and cultural resource heritage took place in 1980, this time at a global level, when Isle Royale was formally designated a U.S. Biosphere Reserve through the Man and Biosphere Programme (MAB) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). MAB is an international program to protect prime examples of major ecosystems that provide a baseline against which human impacts can be compared and evaluated.

3.1.2 Geology and Soils

The rocks seen on the Isle Royale archipelago today bear witness to over a billion years of geologic processes, including successive volcanism, sedimentation, uplift, and erosion (NPS, 1998). The islands' bedrock sequence consists of thick layers of lava and sedimentary rocks that have been tilted toward the southeast; linear ridges oriented along a northeast-southwest axis are the eroded edges of individual layers of the sequence (Huber, 1975). Significant minerals in Isle

Royale are copper, greenstones, datolite, and agates. The oldest rocks in the archipelago date back to the Precambrian era.

Igneous rocks, in particular volcanic ones, dominate the geology of Isle Royale, but sedimentary deposits of sandstones and conglomerates are exposed on the southwestern end of the island. Evidence of Pleistocene glaciation is visible throughout the island and includes bedrock abrasions and striations, deposits of glacial till and landscape features like drumlins and moraines. This extensive Pleistocene glaciation has left a legacy of thin soils and numerous lakes, swamps, and bogs. Higher water levels in Lake Superior in the geologic past are evidenced by inland beach ridges (NPS, 1998).

Fifteen soil series and 14 distinct soil associations have been mapped and described at Isle Royale (Shetron and Stottlemyer, 1991). By and large, the soils on Isle Royale are derived from deposits and outwash left by retreating glaciers and meltwater. Glacial till deposits vary in thickness across the island and are much deeper toward the southwestern end. Soils in the northeastern portion of the island are thin and highly organic; these shallow soils are a major influence in the dominance of boreal forest vegetation in the northeastern part of Isle Royale. This thin mantle of organic soil, plus erosion and soil-burning fires, have combined to expose large expanses of bedrock, especially along ridges. The absence or paucity of soil is probably a limiting factor for vegetation in rocky areas, creating fire breaks and changes in fuel types. In contrast, toward the southwestern end of the park, soils are deeper, better-developed and less organic. These conditions favor northern hardwoods.

3.1.3 Water Resources

Aquatic habitats account for more than three-quarters of Isle Royale's acreage, and encompass a wide spectrum of environments, from the cold, deep waters of Lake Superior to inland streams, beaver ponds, lakes, marshes and bogs. The park includes 438,008 acres of Lake Superior, in addition to about 200 inland lakes and ponds totaling some 9,050 acres. There are approximately 158 linear miles of perennial streams on Isle Royale (ISRO, 2002).

In spite of the ecological importance of aquatic environments, data documenting their condition in the park have been rather scarce to date, although this is beginning to change. An intensive inland lakes water quality baseline study, as well as inventories of the inland lakes fishery and invertebrates (primarily mussels) are underway, nearing completion or being published.

Despite Isle Royale's remoteness and the total lack of nearby industrial or municipal discharges into its waters, several air-borne pollutants, capable of being transported long distances in the atmosphere, have been documented in the park's waters, sediments, flora and fauna. These include sulfur and zinc, mercury, organochlorines, and herbicides. Mercury, for example, has been found in the park's common loons, although at levels lower than those documented in loons in most other parts of the country (Evers, et al., 1996). Several of these heavy metals and organic compounds are subject to biomagnification, that is, reaching greater and greater concentrations in organisms higher on the food chain.

Levels of toxic contaminants in the park's inland lakes are a major concern. Fish monitored in 1992-94 did not exceed State of Michigan advisory levels for human consumption, but some of the

fish sampled in six of the 32 lakes in the 1995-96 inland lakes fishery inventory did exceed these advisory levels for mercury in particular.

The Lake Superior portions of the park, particularly its bays and channels, are heavily used by motorboats. Oil, fuel and sewage discharges from boats can all damage water quality locally. Improper hygiene and human waste (i.e. fecal matter) disposal methods on the part of backcountry users can also cause localized bacteriological contamination on inland streams, ponds, and lakes (NPS, 1998).

3.1.4 Floodplains and Wetlands

Executive Order 11988 on Floodplain Management requires all federal agencies to take action to reduce the risk of flood loss, to restore and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare. Because many wetlands are located in floodplains, Executive Order 11988 has the secondary effect of protecting wetlands.

Executive Order 11990, Protection of Wetlands, states an overall wetlands policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to State or local projects. It requires federal agencies to follow avoidance/mitigation/ preservation procedures with public input before proposing new construction projects.

A formal determination of floodplains on Isle Royale has never been conducted (NPS, 1998). In general, the short, low-gradient streams on the islands pose few flooding concerns, and the only facilities and developments near those watercourses are campgrounds and trails. Beaver dam washouts occasionally cause flash flooding in particular stream segments.

According to the National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service, a number of wetlands are present in the park (ISRO, 2002). This nationwide survey of wetlands and aquatic habitats is based on interpretation of aerial photographs, not a ground survey, and its criteria differ somewhat from those used in jurisdictional wetlands delineations for 404 permitting with the Army Corps of Engineers (Cowardin, et al., 1970). Table 3.1.4-1 gives the number and acreage of different kinds of wetlands found at Isle Royale, using the NWI classification scheme.

Table 3.1.4-1 – Wetlands at Isle Royale National Park

Class	Number	Acreage
Aquatic Bed	5	15
Beach/Bar	1	3
Emergent	270	2,028
Forested	666	17,364
Rocky Shore	35	85
Scrub-Shrub	385	5,279

Source: National Wetlands Inventory, Isle Royale GIS database (ISRO, 2002)

3.1.5 Air Quality

Visibility

Isle Royale National Park is one of 48 units of the National Park System designated as a mandatory Class 1 area for air quality (USEPA, 2001) under the 1977 Clean Air Act Amendments (CAAA). Class 1 areas receive the greatest protection under the CAAA, and the NPS is required to do all it can to ensure that air quality-related values are not adversely affected by air pollutants. To this end, NPS personnel review any permit applications for industrial or other facilities that may contribute to the deterioration of the airshed.

Of particular concern in the Class I areas is visibility, which is critical to preserving views of outstanding scenery and landscapes for which national parks are famous. Both the scattering and the absorption of light by particles in the atmosphere reduce visibility. Section 169A of the 1977 CAAA established "…the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I federal areas in which impairment results from man-made air pollution."

The U.S. Environmental Protection Agency (USEPA) promulgated rules in 1980 that included language directed at "reasonably attributable" sources of visibility impairment. With the addition of section 169B in the CAAA of 1990, Congress addressed "regional haze" visibility in the nation's national parks and wilderness areas. The USEPA has determined that all 156 mandatory Class I areas across the nation demonstrate impaired visibility based on Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring data (USEPA, 1999). At Isle Royale, air quality monitoring in the late 1980's and early 1990's included participation in the IMPROVE aerosols monitoring network, as well as ozone and visibility monitoring. Funding limitations eliminated these programs, although an IMPROVE station was installed at a "surrogate" location on the Michigan mainland at Eagle Harbor (where a needed year-round power source is available) in 2000 to again monitor particulates related to visibility.

The USEPA published final regional haze regulations on July 1, 1999 (64 FR 35714). The rules are directed at four emission sources of visibility impairment – stationary sources (industry), mobile sources (vehicles), area sources (e.g., gas stations, dry cleaners, etc.), and the use of prescribed fire. Among the pollutants most responsible for haze (i.e., nitrates, sulfates, soil material, ozone, organic carbon, and elemental carbon) the last three are found in smoke from vegetative burning or are derived from components of smoke. The goal of the regional haze program is to show continuous improvement in monitored visibility in the Class I areas so that natural background conditions are restored by 2064. The rules require that each state submit a State Implementation Plan (SIP) to the EPA to implement the emissions reductions necessary to improve visibility in the parks and wilderness areas.

At Isle Royale, a review of the 1990's visibility monitoring data (from color slides taken in 1991 and 1992) revealed anomalies attributed to pollutants on 27 of 276 days during which monitoring was completed, with an additional 55 days having anomalies likely attributed to pollutants (Air Resource Specialists, 1995). At least some of these visibility-impairing pollutants appear to have originated from industrial sources (such as a pulp mill) in Thunder Bay, Ontario (NPS, 1998).

Ozone, Particulates, and the Other "Criteria Pollutants"

Under the Clean Air Act, as amended in 1977 and 1990, the USEPA sets federal air quality standards for allowable emissions for several pollutants considered harmful to public health or the environment, including six principal or "criteria" pollutants: carbon monoxide, nitrogen oxides, ozone, particulate matter, lead, and sulfur dioxide. Many of these pollutants, named above as contributors to haze, are regulated individually.

In addition, some pollutants (nitrogen oxides or NOx and volatile organic compounds or VOC's) react chemically to form ozone in the presence of sunlight, and others (particulate sulfates and particulate nitrates) combine to form "smog." At Isle Royale, results from past and current monitoring have shown elevated levels of ozone (O_3) and sulfur dioxide (SO_2) in the park. With no sources of these anthropogenic pollutants in the park, long-range aerial transport has been identified as the mechanism that has carried the pollutants to the park's airshed. Some monitoring for ozone has shown levels exceeding background conditions, occasionally even exceeding the threshold of harm to vegetation.

Park staff have also documented odors from the pulp mills in Thunder Bay. From 1992-99, pulp smells (hydrogen sulfide, in particular) were evident on Isle Royale 20% of the days.

"Criteria Pollutants" for which National Standards have been set under the Clean Air Act

Carbon Monoxide (CO). CO is a colorless, odorless, toxic gas produced by the incomplete combustion of organic materials used as fuels. CO is emitted as a by-product of essentially all combustion.

Ozone (O_3). O_3 is a photochemical oxidant and a major constituent of smog. Ozone is formed when two precursor pollutants, hydrocarbons (VOC's) and nitrogen oxides, react chemically in the presence of sunlight.

PM_{10}. PM_{10} are fine particles less than 10 micrometers in diameter. PM_{10} includes solid and liquid material suspended in the atmosphere and formed as a result of incomplete combustion.

Sulfur Dioxide (SO_2). SO_2 is a corrosive and poisonous gas produced mainly from the burning of sulfur-containing fuel. It is also a precursor to acid precipitation.

Nitrogen Oxides (NOx). NOx are poisonous and highly-reactive gases produced when fuel is burned at high temperatures, causing some of the abundant nitrogen in the air to burn as well.

Lead (Pb). Pb is a toxic heavy metal, the most significant emissions of which derive from gasoline additives, iron and steel production, and alkyl lead manufacturing.

Deposition of Air Pollutants into Water and Soils

Certain toxic contaminants released to the air may not only be transported long distances, but find their way back to earth again, where if concentrated enough, they can cause environmental problems to terrestrial and aquatic ecosystems. At Isle Royale, this is a major concern, particularly with elemental sulfur, the heavy metals mercury and zinc, and certain synthetic organic compound such as organochlorine insecticides (like DDT) and herbicides. Various studies, both

past and ongoing, include sampling to document bio-toxins in sediment, water, or body tissues or eggshell fragments. In 1993, lake trout in Siskiwit Bay exceeded the Michigan advisory for total chlordane and toxaphene (both organochlorine insecticides), total poly-chlorinated biphenyls (PCB's), mercury and total DDT (MDNR, 1994). While there has been a resurgence in bald eagle and osprey nesting at Isle Royale as well as a dramatic increase in the double-crested cormorant population, all of which are correlated in part to declining levels of PCB's and other contaminants, the long-term, potentially insidious effects of the bio-toxins remains a serious concern both within the park and throughout the region.

Acid deposition is a major environmental problem in certain parts of North America, such as southeastern Canada and the northeastern United States, which both: 1) are exposed to high concentrations of sulfuric and nitric acid in rain, fog, and snow, and, 2) possess poorly-buffered rock, soils, and water. In the Canadian shield to the east and north of Isle Royale National Park, for example, acid precipitation and acidified surface waters over the past century are considered responsible for the reduction or disappearance of some amphibians and fish. Isle Royale operates an acid deposition monitoring station to document trends. At the present time, acid deposition is not believed to be problematic.

Wildland Fires and Air Quality

The combustion of vegetation produces various chemical compounds. These compounds include nitrogen oxides (NOx), organic compounds, carbon monoxide, and particulate matter or small particles (PM). The pollutants that affect visibility that derive from vegetative burning are PM_{10}, $PM_{2.5}$, nitrates, ozone, organic carbon, and elemental carbon. Ozone, which as stated above can form "smog" or haze, is not directly produced by fires, but as a byproduct of the chemical reaction other combustion products (NOx and volatile organic compounds or VOC's). About 90 percent of smoke particles from wildland and prescribed fires are PM_{10} and about 70 % are $PM_{2.5}$ (MNICS, 2001).

One of the main factors determining the degree of air pollution from wildland fires is smoke dispersion. Smoke dispersion is a function of ventilation, which refers to the process within the atmosphere that mixes and transports smoke away from its source. Ventilation is a function of stability, mixing height, and transport winds. Mixing height is defined as the upper limit of a mixed layer in unstable air, in which upward and downward exchange of air occurs. The transport wind is the arithmetic average (speed and direction) of wind in the mixing layer.

3.1.6 Vegetation

Isle Royale and the adjacent lake country of Minnesota, with their continuous forest cover, abundant wetlands and lakes, and sense of vastness and isolation, are perhaps closer to the true sub-arctic environment than any other region of the United States outside Alaska. Lake Superior moderates this arctic influence, and arctic-induced coolness provides a zone of tension between the boreal forest and the northern hardwood forest.

Two major biomes occur at Isle Royale: the boreal coniferous forest and the northern hardwoods forest (Linn, et al., 1966). The former generally occurs in the cooler, damper areas of the park, which tend to be found toward the northeast. Balsam fir (*Abies balsamea*) and white spruce

What are "Climax Vegetation," "Succession," and "Seral Stages?"

Climax vegetation is the structure and species composition that a particular floral community in a given ecosystem or biome (large-scale plant communities) will tend toward, via the process known as *succession*, in the absence of disturbances such as fire, major disease or insect infestations, clearing, or logging. Depending on the type of community (forest vs. grassland, for example), it can take anywhere from decades to centuries for the climax community to be reached. Climax communities are regarded as self-perpetuating (able to persist indefinitely unless disturbed). A *seral stage* or *sere* is a phase through which the dominant vegetation on a given site passes en route to the climax community; it is typically characterized by different dominant species than the climax phase. For example, on Isle Royale quaking aspen and paper birch are the dominant tree species in one of the seral stages en route to the balsam fir and white spruce climax community.

(*Picea glauca*), interspersed with pockets of paper birch (*Betula papyrifera*), comprise the so-called "climax" of the boreal coniferous forest. Seral stages of this forest type, that is, earlier phases, are dominated by quaking aspen (*Populus tremuloides*) and paper birch; these areas, typified by the 1936 burn site, cover about 20% of the main island. Frequent natural disturbance in the boreal forest from windthrow, insect and fungus attack, preferential feeding by herbivores like moose, fire, drought, etc., make it a highly dynamic community.

The northern hardwoods forest biome is found on warmer, drier sites with adequate soil; these tend to be in the southwestern areas of the park. Sugar maple (*Acer sacharum*) and yellow birch (*Betula alleghaniensis*) are dominant here. This community is more stable and less disturbance-prone, including to fire, than the boreal forest. Xeric (drier) ridges are occupied by small, open stands of northern red oak (*Quercus rubra*), white pine (*Pinus strobus*), jack pine (*P. banksiana*), spruce (*Picea* sp.), red maple (*Acer rubrum*), or occasionally red pine (*P. resinosa*). In swamps and wetland forests of the park, black spruce (*Picea mariana*), white cedar (*Thuja occidentalis*), and eastern tamarack or larch (*Larix laricina*) are dominant.

Non-forested areas on the ridges support patchy grasses and shrubs, primarily common juniper (*Juniperus occidentalis*), serviceberry (*Amelanchier* spp.), honeysuckle (*Lonicera* spp.), hazelnut (*Corylus americana*) and blueberry (*Vaccinium* sp.). These areas, prone to lightning because of their exposure, have burned frequently, leaving little organic soil and thwarting forest encroachment.

Bogs and beaver meadows are dominated by dense stands of sedges, rushes, grasses, and shrubs such as alder at the margins. Two kinds of bogs exist at Isle Royale. **Sphagnous bogs** are dominated by the sedge *Carex limosa*, and have little or no drainage. Other common species in sphagnous bogs are sphagnum moss (*Sphagnum* sp.), Labrador tea (*Ledum groenlandicum*), black spruce, and tamarack. **Cyperaceous bogs** are dominated by the sedge *C. lasiocarpa* and often have an active water outlet. They tend to have less Labrador tea and sphagnum moss ground cover, but support larch and white cedar as an overstory (NPS, 1998).

Overall, approximately 700 species of vascular plants have been recorded at Isle Royale, of which slightly more than 100 species are exotics (Judziewicz, 1995a). At least 30 different vegetation alliances have been identified on the island, within the two broad communities or biomes described above.

Broad characteristics of the Isle Royale's forests appear to have changed relatively little over time. Boundaries of contemporary forest communities generally correspond to those present in the park at the time of the first General Land Office survey by William Ives in 1847. Ninety percent or more of the park is in the same forest type as in 1847, differing only in seral stage, despite extensive Euro-American human use and exploitation. Yet several forest types are now undergoing significant changes. There is widespread paper birch mortality in older stands due to drought-induced stress and insect/disease attack. Balsam fir is rapidly declining on the west end due in part to intensive moose browsing, while substantial growth continues on the east end. Aging white spruce stands are also experiencing insect/disease mortality (Janke et al., 1978).

Moose browsing is creating considerable impact on several tree species, primarily balsam fir, white birch, and aspen; the Canada yew (*Taxus canadensis*), an understory bush favored as moose browse, has almost vanished from the main island. The issue of moose browsing and its effects on vegetation composition and forage quality is complex (Brandner, et al., 1990; Cochrane, 1991). It also has a bearing on fire behavior and fire management concerns due to changes in fuels conditions in the park. This issue is presently the subject of a research project that began in 2000.

Researchers have postulated a "spruce-moose-savanna effect," whereby intense browsing pressure by moose suppresses replacement trees, opening up the forest canopy and possibly reducing forest flammability from its pre-moose condition. Few balsam firs, the preferred winter browse species of moose, are able to escape the extreme browsing and make it into the canopy over much of the park. In recent years, the overall quality of moose forage has declined, especially on the northeastern end of Isle Royale. Browse activity has changed the composition, not just the density, of the understory of the park's boreal forests as well; the principal understory plant described by the Ives survey in 1848 was the Canada yew (also known as American yew, ground hemlock, or sometimes "moose candy" in reference to its popularity with these large herbivores) a highly flammable "ladder fuel." Today the yew is rare, limited to pockets of low moose density. Thimbleberry (*Rubus parviflorus*), the most common understory shrub in the park now, was not even mentioned in the 1848 Ives report. Moose do not eat it, and normally it will not carry fire because of its high moisture content.

The1936 burn area furnished abundant forage for moose in the years following the fire, so much so that the moose population could not increase fast enough to avail itself of this surplus food, and a number of trees were thus able to "escape" over-browsing and mature. The aging paper birch and aspen forests in this area now provide the poorest moose habitat in the park.

Approximately 95% of the park is in a Wildland Fire Use zone, wherein lightning-caused fires are allowed to burn under most circumstances. In theory, this policy should allow fire to regain its stature as an ecological force on the island; yet very little area actually burned in the 1990's, despite some dry summers. The combination of forest types (hardwoods, birch, and aspen) and moose browse impacts may have tempered the typical heavy build-up of fuels associated with decades of earlier fire suppression.

Many fire-dependent species, like jack pine, and fire-adapted species, like white pine, will decline without its return. The first prescribed fire in the park occurred in 1999, when park staff burned the

small Daisy Farm field, but prescribed fire may be used more frequently as a management tool in the future if fire/herbivory research and ecosystem management objectives indicate the need to do so.

Most insect and disease impacts appear to be natural events, with the notable exception of blister rust on the island's white pines; with no method of control for the blister rust, an important resource on the island may eventually disappear from this alien disease (ISRO, 1999). The park experienced widespread outbreaks of native tree pests in the dry years of the 1990's, including Tortrix (*Archips conflictana*), which affected aspen and birch, and spruce budworm (*Choristoneura fumiferana*) which affected balsam fir and white spruce.

Serious concerns exist about alien species of flora at Isle Royale (Judziewicz, 1995b). Spotted knapweed (*Centaurea maculosa*) has been found in several places in the park, and is aggressively pulled and mapped wherever it is found. Overall, however, a parkwide acreage assessment of infestation by non-native plants does not exist and few species are being actively monitored and addressed.

Passage Island merits a brief mention in this section, as it is approximately four miles northeast of the main island and large enough to have significant vegetation that can burn. Moose have never colonized Passage Island, so Canada yew, which they have over-browsed on the main island, is still quite plentiful. Most of Passage Island's vegetation is composed of wind-dispersed species and its vegetation is very different from the rest of the park. There is virtually no white spruce on Passage Island; in contrast it includes a large mountain ash (*Sorbus americana*) component. This island is one of the most unique forest habitats in all of Michigan.

3.1.7 Wildlife and Fisheries

Terrestrial Wildlife

Isle Royale's terrestrial wildlife is a classic example of island biogeography theory, which predicts that biodiversity on islands is less than on mainland areas, as a result of both distance from the mainland (that limits colonization) and the constrained ability of an island of a given size to support viable and genetically healthy populations (MacArthur and Wilson, 1967). For instance, only fourteen species of mammals are known to breed in the park, compared to about three times that number on the north shore of Lake Superior. Many species of mammals cannot swim across Lake Superior and will not cross ice when the lake freezes on occasion. Colonization of the island is by chance dispersal and natural extinction of small populations that do arrive and establish themselves is also a constant possibility. Caribou, coyote and the lynx have all disappeared from Isle Royale since the arrival of Euro-Americans, although they were more likely extirpated by humans than by natural causes.

Mammals include the red fox, snowshoe hare, mink, short-tailed weasel, beaver, deer mouse, red squirrel, muskrat, river otter, and three species of bats (little brown myotis, Keen's myotis, and big brown bat myotis) (NPS, 1998). The two best-known mammals on Isle Royale are the moose and the timber wolf. These creatures have been the subject of the longest-running, predator-prey research and monitoring project in the history of wildlife management, initiated by Professor Durwood Allen and his graduate students in 1958 and continuing to this day (Allen, 1979). Since

the mid-1970's, Dr. Rolf Peterson of Michigan Tech has continued the studies. Moose colonized Isle Royale in the early 1900's, either by swimming or crossing ice from the Canadian mainland. Before wolves arrived in the late 1940's, the moose population exploded, over-browsed the vegetation, and collapsed twice. The second population boom was aided by the production of vast amounts of new browse after the 1936 fire (Peterson, 1977).

No animal symbolizes the essence of Isle Royale wilderness more than the timber wolf. Its widely fluctuating numbers, including some dramatic dips and rises in the 1990's, fascinates both researchers and the public. Studying these population dynamics increases our knowledge and awareness of the park ecosystem. The late 1980's and early 1990's concerns over the possible extinction of the island's wolf population remain, although those concerns have lessened as a new generation of breeding pairs have become established within the territorial packs and pup survival has increased.

The 2000-2001 wolf winter survey showed that the total wolf population, in three packs, dropped by a third to 19 from 29 the year before (Peterson and Vucetich, 2001). Total mortality was 15, offset somewhat by the raising of five pups. The park's moose herd, meanwhile, has increased slowly since the summer of 1996 and numbers approximately 900. A major challenge for Isle Royale moose is the poor winter food supply, especially on the southwest end of the island, where these herbivores often must survive on lichens. Moose on the northeast end do better because of the large balsam fir stands growing there (Uhler, 2002).

Little is known about Isle Royale's reptiles and amphibians, but their occurrence is doubtless influenced profoundly by island biogeography as well. Three species of reptiles have been documented – the western painted turtle, red-bellied snake, and garter snake – as have seven amphibians – the blue-spotted salamander, American toad, spring peeper, chorus frog, green frog, mink frog, and wood frog (NPS, 1998).

Due to migration and their much greater mobility and ability to disperse, birds are less affected by the isolation of Isle Royale than the foregoing taxa. Bird diversity tends to mirror that of nearby mainland areas in Michigan, Minnesota and Ontario. Two notable absences are the ruffed grouse and the spruce grouse, which are non-migratory and unable to make the flight across the open waters of Lake Superior. Bald eagle and osprey populations continue to rebound at Isle Royale; in the 1960's and 1970's pesticide poisoning eliminated nesting of these two majestic raptors in the park (NPS, 1997a). Both birds began nesting again at Isle Royale in the 1980's. By 2000, 14 fledglings were produced from twelve eagle nests and seven fledglings were produced from seven osprey nests (Romanski, 2000). Isle Royale has the only known common loon nesting on all of Lake Superior. The population appears to be stable and ongoing research is aimed at understanding the ecology of loons and the effects of mercury bioaccumulation in these fish-eating birds at the top of the food pyramid.

Another raptor recovering from pesticides across North America is the peregrine falcon (*Falco peregrinus*). From 1987-91 the park released 50 young peregrine falcons from two locations on the island. Although peregrines are occasionally sighted, it is not believed that any successful nesting has yet occurred.

Some 58 species of forest songbirds have been documented at Isle Royale from monitoring begun in 1994 (NPS, 1997b). The most abundant are the white-throated sparrow, Nashville warbler, ovenbird and red-eyed vireo. Park staff have begun an annual monitoring program for neotropical migratory birds based on accepted protocols. In the 2001 breeding bird survey, a total of 54 species and 1425 individuals were recorded (Egan, 2001). The number of species was slightly below the five-year (1996-2000) average of 59, while the number of individuals was above the five-year average of 1353. The majority of these species are neotropical migrants, which comprise about half of the breeding songbirds on Isle Royale. Neotropical migrants winter in Central or South America.

Populations of colonial waterbirds in the park appear healthy. These include the great blue heron, double-crested cormorant, herring gull and ring-billed gull. Numbers of cormorants have increased dramatically in recent years, as they have throughout the Midwest.

Fisheries and Aquatic Life

Isle Royale's Lake Superior and inland waters (lake) fisheries are the most nationally significant natural resources of the park; 61 species are known to be present (ISRO, 1999). The park's lake trout (*Salvelinus namaycush namaycush*) population is acknowledged as the best example of a rehabilitated lake trout stock in all of Lake Superior. This population is now regarded as the healthiest as well as the most genetically diverse in the lake. It is also the object of most fishing efforts in the Lake Superior portion of Isle Royale.

The Isle Royale population of the extremely rare coaster brook trout (*Salvelinus fontinalis*) is the only known reproducing population in U.S. waters. In fact, eggs from this population have been used by the U.S. Fish and Wildlife Service (USFWS) in efforts to re-establish the coaster brook trout elsewhere in the Great Lakes (USFWS, 1998). Coasters are large, and unlike their smaller brook trout relatives, they spend most of their lives in Lake Superior, returning to the rivers during fall spawning runs (Anon., 2001).

Information on the other fish species in the Lake Superior waters, particularly the non-game species, is scanty. Species known to be present include herring, whitefish, suckers, sturgeon, northern pike, walleye and yellow perch. Lake herring (*Coregonus artedii arcturus*) appeared to be making a strong comeback in the early 1990's, but by 2000 appeared to have dipped again.

The park's inland waters contain northern pike, walleye, brook trout and lake trout. Recently, surveys and inventories have been undertaken for zooplankton and mussels within Isle Royale's inland waters. So far, the park seems relatively free of infestation from alien aquatic species, such as the sea lamprey (*Petromyzon marinus*), ruffe (*Gymnocephalus cernuus*), and zebra mussel (*Dreissena polymorpha*).

3.1.8 Threatened and Endangered Species

This section and Appendix E of this document summarize information on species of plants and animals at Isle Royale National Park listed by the federal government (USFWS) or the State of Michigan as threatened or endangered. In addition, species of special concern designated by the state are listed in Appendix E.

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544) provides the legal framework by which imperiled species of plants and animals and their critical habitat are designated and protected by the federal government.

A current list exists at the park for federally-listed flora and fauna, which includes the endangered timber wolf and threatened bald eagle. No plant species are on the federal list. The more dynamic State of Michigan list of endangered and threatened species and species of special concern includes many animal species found on Isle Royale, including six species of fish and 23 species of birds, in addition to more than 60 plant species (Michigan State University, 1999a and 1999b).

Federal Endangered Species

An "endangered species" is one that is threatened with extinction throughout all or a significant portion of its range. With the recent (April 2003) reclassification of the timber or gray wolf from endangered to threatened status, there are now no federally-endangered species resident at or frequent visitors to Isle Royale. The peregrine falcon (*Falco peregrinus*), which is found in the park, was listed as an endangered species in 1970, but was de-listed in 1999 as a result of recovery of its populations from successful efforts at captive breeding and reintroductions (TPW, 1999; WDFW, 2002).

Federal Threatened Species

Threatened species are assumed to be vulnerable to become endangered, and so are offered protection similar to that for endangered species. Two federally-threatened species occurs at Isle Royale: the gray wolf and the American bald eagle.

- **Gray wolf** (*Canis lupus*) – Originally, the gray wolf resided over most of the eastern United States, but it was wiped out as human populations grew, habitats were modified, and prey species and the wolf itself were killed. The wolf was officially listed as endangered by the federal government in 1974. As a result of the recovery of wolf populations in recent decades to more robust levels, the USFWS decided to reclassify the timber wolf from endangered to threatened in some areas of the country and remove it altogether from the endangered species list in other parts (USFWS, 2000; Lazaroff, 2000). In April 2003, USFWS reclassified it as threatened in Michigan. The State of Michigan DNR also lists the wolf as threatened (reclassified from endangered in 2002).

  Wolves have been at Isle Royale since the late 1940's, having arrived naturally by crossing Lake Superior when it was frozen one winter. Their population size fluctuates from about a dozen to several dozen and they feed primarily on Isle Royale's moose herd (Peterson and Vucetich, 2001). Isle Royale has been designated critical habitat for the wolf (USFWS, 1992). Due to the special status of the wolf population on Isle Royale, the park may well continue to treat *Canis lupus* as a species of concern even if it is de-listed by the USFWS.

  Generally speaking, timber wolves in nature are well-adapted to fire in the landscape. Adults are usually able to escape it, are not terrified of it, and may even use it to their

advantage in hunting. For example, during the 1988 fire at Minong Ridge on Isle Royale, collared wolves were observed near the fire, perhaps on the lookout for displaced prey (Peterson, 2003). Nevertheless, young wolf pups could be vulnerable to injury or death from spring or early summer fires, though certainly their mothers and below ground dens would offer them a degree of protection.

- **Bald Eagle** (*Haliaeetus leucocephalus*) – The bald eagle is also listed as by the State of Michigan. However, the USFWS plans to de-list this bird as a result of its increasing numbers around the country (USFWS, 1999). The reason for historic declines in bald eagle populations in the 1950's and 1960's included PCBs, DDT, DDE, mercury, and disturbance and displacement by humans. DDT was the primary cause and the banning of DDT in the early 1970's has led to a resurgence in numbers throughout the U.S. as well as in the park. Bald eagles began nesting again at Isle Royale in the 1980's. By 2000, 14 fledglings were produced from twelve eagle nests and (Romanski, 2000).

  Bald eagles nest in mature trees in the park, which are potentially vulnerable to fire, although other trees that survive fires would be available for new nest construction.

State-Listed Species

A number of species listed by the State of Michigan as endangered, threatened, or species of special concern are found at Isle Royale. These species and sub-species are not afforded the same formal protection provided by the Endangered Species Act, but they are monitored and may one day become candidates for the federal list, if their numbers continue to trend downwards. Species listed by the State of Michigan are presented in Appendix E and are here only summarized.

- **State-Endangered plants:** There are six species of state-endangered plants at Isle Royale.
- **State-Endangered animals:** There is one state-endangered mammal at Isle Royale, the gray wolf, and two state-endangered birds, the short-eared owl and piping plover.
- **State-Threatened plants:** There are 37 species of state-threatened plants at Isle Royale.
- **State-Threatened animals:** There are three species of state-threatened fish at Isle Royale, the lake sturgeon, lake herring, and shortjaw cisco, and nine state-threatened birds.
- **Plants of special concern:** There are 15 plant species of special concern in the state.
- **Animals of special concern:** There are three fish species and/or sub-species of special concern at Isle Royale, the Siskiwit Lake cisco, kiyi, and spoonhead sculpin, and one mammal of special concern, the moose.

3.1.9 Wilderness

Wilderness is defined in the 1964 Wilderness Act (P.L. 88-577) as a place where natural forces, not human ones, predominate. It is "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." Due to its remoteness and relatively pristine condition, Isle Royale possesses this wilderness character, perhaps as much or more than any U.S. national park outside of Alaska. In any case, its wildness

has been recognized by Congress, which in 1976 designated 131,880 land acres of the park – almost 99 percent of it – as Wilderness. An additional 231 acres have been designated as potential Wilderness, and are managed as such. In essence, the entire park outside of those areas containing administrative and visitor facilities, is designated as Wilderness.

Wilderness is at the heart of what the park offers visitors to Isle Royale. The park's GMP amply identifies the importance of Wilderness to the park, focusing on it in two of the five park purpose statements and one of the three park significance statements (NPS, 1998).

Management of the Isle Royale Wilderness is accomplished through the Backcountry Management Group, which includes the Branch Chiefs for Natural Resources, Cultural Resources, and Interpretation, the Trails Foreman, and the East and West District Rangers. Isle Royale continues to operate without an approved Wilderness Management Plan (WMP), although development of a WMP began in 1999. Significant issues to be addressed include visitor use management to enhance the wilderness experience – a very broad-ranging topic – and minimum tool requirements for all park operations. Wilderness/backcountry visitor use has been documented through a backcountry permit process, using a computerized permit/itinerary program.

Isle Royale's Wilderness resource faces several issues. The Wilderness Act defined wilderness areas as having "...outstanding opportunities for solitude..." yet the park Wilderness faces severe noise impact problems. Of primary concern are aircraft overflights, recreational and NPS operational motorboat noise, noise from large groups and adjacent visitors in campgrounds, and portable generators at docks; of lesser concern is the noise related to park management, coming from operations at Mott Island, Windigo, and Rock Harbor. Noise impacts are probably the greatest threat to the integrity of Isle Royale Wilderness (ISRO, 1999).

There are also visitor use conflicts, primarily between powerboaters and non-powerboaters, in the campground setting. The expectations and attitudes of what "wilderness" means differs among these groups, and some degree of conflict is inevitable. Efforts have been made to separate these groups as much as possible within limited design change opportunities, but the conflicts persist.

With regard to fire management in designated wilderness areas, NPS policy stipulates that:

> Fire management activities conducted in wilderness areas will conform to the basic purposes of wilderness. The park's fire management and wilderness management plans must identify and reconcile the natural and historic roles of fire in the wilderness, and will provide a prescription for response, if any, to natural and human-caused wildfires. If a prescribed fire program is implemented, these plans will also include the prescriptions and procedures under which the program will be conducted within wilderness.
>
> Actions taken to suppress wildfires will use the minimum requirement concept, and will be conducted in such as way as to protect natural and cultural resources and to minimize the lasting impacts of the suppression actions (NPS, 2001; Section 6.3.9).

To date, no prescribed fires have been conducted within Isle Royale's designated Wilderness.

3.1.10 Noise

Noise is defined as unwanted sound (INCE, 1995). The particular pattern (location, duration, timing and frequency) of human activities gives rise to a perception of noise. The loudest sounds that can be detected comfortably by the human ear have intensities that are 1 trillion (1,000,000,000,000) times larger than those of sounds that can just be detected. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level. The loudness of sound as heard by the human ear is measured on the A-weighted decibel (dBA) scale. Normal speech has a sound level of approximately 60 dBA. Sound levels above about 120 dBA begin to be felt inside the human ear as discomfort and eventually pain at still higher levels (DOD, 1978). Examples can be found in Table 3.1.10-1.

Table 3.1.10-1: Common Noise Levels and Their Effects on the Human Ear

Source	Decibel Level (dBA)	Exposure Concern
Soft Whisper	30	Normal safe levels
Quiet Office	40	
Average Home	50	
Conversational Speech	66	
Busy Traffic	75	May affect hearing in some individuals depending on sensitivity, exposure length, etc.
Noisy Restaurant	80	
Average Factory	80 - 90	
Pneumatic Drill	100	Continued exposure to noise over 90 dB may eventually cause hearing impairment.
Automobile Horn	120	

(DOD, 1978)

Certain land uses, facilities, and the people associated with these noise levels are more sensitive to a given level of noise than other uses. Such "sensitive receptors" include schools, churches, hospitals, retirement homes, campgrounds, wilderness areas, hiking trails, and some species of threatened or endangered wildlife. Recommended land use and associated noise levels are illustrated in the following table (Table 3.1.10-2). The only land use category in the table below that is well-represented within Isle Royale National Park is "Natural Recreation Areas."

In recent decades, noise has become a controversial issue in certain national parks, as many parks that retain their historic appearance no longer sound as they once did, due to the widespread proliferation of motorized and human-generated noise from a variety of sources across the American landscape. In response, NPS management policies call for the preservation of, "to the greatest extent possible, the natural soundscapes of parks" (NPS, 2000; Section 4.9). Human activities that generate noise are to be monitored, and it is NPS policy to prevent or minimize noise that affects the natural soundscape or exceeds levels appropriate for visitor uses.

Section 8.2.3 of the 2001 *Management Policies* directs the NPS to "strive to preserve or restore the natural quiet and natural sounds associated with the physical and biological resources of parks." Where use of motorized equipment is necessary and appropriate, the "least impacting" equipment and vehicles should be used, consistent with public and employee safety.

Table 3.1.10-2: Recommended Land Use Noise Levels

Land Use Category	Noise Levels			
	Clearly Acceptable	Normally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential	< 60	60-65	65-75	> 75
Commercial, Retail	< 65	65-75	75-80	> 85
Manufacturing	< 55	55-70	70-80	> 80
Agriculture, Farming	< 75	> 75		
Natural Recreation Areas	< 60	60-75	75-85	> 85
Hospitals, Schools, Libraries, Churches, Nursing Homes	< 60	60-65	65-75	> 75
Playgrounds	< 55	55-65	65-75	> 75

(HUD, 1991)

Some conservationists argue that auditory solitude, that is "quietude," was recognized by the drafters of the 1964 Wilderness Act and is implied by the act's language (Matzner, 2001). NPS policy on wilderness management explicitly recognizes the incompatibility of man-made noise with wilderness. Since 99% of Isle Royale National Park is Congressionally-designated Wilderness, and managed so as not to impair its wilderness attributes, park management must consider potential impacts of motorized equipment to the character, aesthetics, and traditions of wilderness (NPS, 2000; Section 6.3.4.3). Some visitors to the park use motorboats and airplanes both for access and recreation. Passing outboard motorboats can reach levels of 80 dB (in the range of an "average factory" in the table above), while propeller aircraft generate 120 dB (Roeser, no date). The noise from these sources, while intermittent (not constant), does occur on a daily basis and penetrates well into the backcountry and wilderness areas of the park. Motorboat noise is confined to the park's periphery and its outer channels and islands, and would not reach the most interior portions of the main island itself. Airplanes, however, can fly over Isle Royale, and their sound waves have unobstructed access to reach wider areas, encompassing the entire park.

As Section 3.1.9 above points out, the park's designated Wilderness faces severe noise impact problems from aircraft overflights, recreational motorboat noise, noise from large groups and adjacent visitors in campgrounds, and portable generators at docks; of lesser concern is the noise related to park management, coming from operations at Mott Island, Windigo, and Rock Harbor. Noise impacts may be the greatest threat to the integrity of Isle Royale Wilderness. Throughout North America as a whole, the limited research and surveys to date into attitudes of backcountry users toward mechanical and other human noise (loud voices, rowdiness, radios, tape-players,

etc.) do suggest that noise can be annoying and interfere with visitor experience (Gramann, 1999).

In addition to intruding on wilderness solitude, another potential impact of human and motorized noise is on wildlife. Some scientists believe that around the world, noise pollution is contributing to the depletion of wildlife populations, although this is very difficult to quantify and has not been documented at Isle Royale in particular. Research into the effects of noise on wildlife has been growing rapidly since the 1970's, yet often presents contradictory results because of the complexity of factors and the difficulty of isolating variables; nevertheless, most researchers agree that noise can affect an animal's physiology and behavior, and if it becomes a chronic stress, can be detrimental to an animal's energy budget, reproductive success and long-term survival (Radle, 1998). The long-term effects from medium to low-level noise intrusion need much more research, with emphasis on threatened and endangered species. The synergistic effects of noise with other stressors on animals also need investigation (Cornman, 2001).

3.2 CULTURAL RESOURCES

3.2.1 Historical Overview

Isle Royale's natural resources have attracted many human visitors and some residents for millennia. Isle Royale's cultural resources date from Archaic times (c. 3000 BC) to the present and thus trace almost 50 centuries of human activity. While the island was a very rich source of fish, wildlife, plants, and minerals, it was an extremely isolated and difficult place in which to live. The various themes of island history are represented by archeological sites, structures, museum objects, cultural landscapes, and ethnographic resources (NPS, 1998).

Isle Royale's earliest users were Archaic-period aboriginal copper miners. Later, native groups visited the island to dig copper, hunt, fish, and gather plants and berries. Fur-bearers attracted Euro-American trappers and traders during the 1600's and 1700's. This era's explorers and missionaries provided the first historic accounts of the island.

Two of the island's most valuable natural resources – fish and copper – drew numerous explorers and entrepreneurs over the past several centuries. Coming thousands of years after the prehistoric copper miners, three phases of historic copper mining occurred in 1843-1855, 1873-1881, and 1889-1893 (Rakestraw, 1965). Some companies had limited success and initially found mining profitable. But copper veins soon petered out and the cost of maintaining an operation on an isolated island in the far reaches of Lake Superior eventually caused all of them to go out of business.

As the Great Lakes fur trade waned in the 1830's, the American Fur Company turned to the abundant trout and whitefish populations around Isle Royale, ushering in a century of commercial fishing. At the peak in the early 1900's, more than 100 fishing families were based on the island (NPS, 1998).

Enterprising commercial fishers were the first to accommodate tourists and vacationers on Isle Royale. The island offered a rugged vacation destination with excellent fishing, elbow room, and clean air to turn-of-century city dwellers. By the 1910's and 1920's, a number of resorts and summer homes dotted the island.

The growth of tourism on the island was fostered by Great Lakes Shipping companies. The Singer Transportation Company opened a resort on Washington Island in 1902 to compete with rival A. Booth and Company. Isle Royale became a resort destination with lodges at Belle Isle, Tobin Harbor, and Rock Harbor, plus the smaller sites run by commercial fishermen. Many families purchased plots and built summer cabins around the island. The tourism industry thrived until the 1930's, when the idea for a national park was initiated.

The conservation movement and concern for Isle Royale in the face of mounting logging pressure brought the federal government's involvement in creating a national park. In doing so, Civilian Conservation Corps (CCC) volunteers played an important role in development of park trails and facilities on the island. Between 1935 and 1941, CCC camps were posted at Siskiwit Bay, Rock Harbor (Daisy Farm), and Washington Harbor. They were instrumental in fighting the 1936 fire.

Isle Royale also has a rich maritime history. Copper mining and the growth of Lake Superior shipping stimulated the establishment of four lighthouses around Isle Royale. For many ships, the island became either a large obstacle or served as a safe haven in times of severe weather. For others, it was a destination point for passengers and freight. Increased boat traffic inevitably brought shipwrecks – ten large ships and numerous smaller vessels have sunk in Isle Royale's waters.

Developed zones and cultural sites comprise less than one percent of the total Isle Royale land acreage. In spite of their small extent, these many sites are diverse and provide important insights into the long history of humanity's presence and influence on the island.

3.2.2 Archeological Sites

The earliest documented use of the island was by Archaic period peoples (approximately 2500 to 1000 BC). At least twelve sites from this period have been identified. Much more numerous are Initial (1000 BC - AD 700) and Terminal or Late (AD 600 - 1650) Woodland sites. These prehistoric sites enhance our knowledge of early mining technology and provide insight on the folkways of prehistoric peoples, including food gathering and preparation, and hunting and fishing technology (Clark, 1990). Although only the Minong Mine site is presently listed on the National Register of Historic Places, many of the prehistoric sites have the potential and integrity to yield additional information about the island's earliest use and culture and may be determined eligible for the National Register.

Many archeological sites contain historic remains along with prehistoric evidence. Fur trade and Native/European contact goods have been found in various places. The fishery bases of the American Fur Company (1837-1842) and the camps of commercial fishing families often occur near or on prehistoric sites. Mining pits and settlements and lighthouse-associated sites have all been identified from the historic period.

3.2.3 Historic Structures

The park contains approximately 180 structures that are more than 50 years old (NPS, 1998). The structures are vestiges of the island's maritime heritage (lighthouses and fishery sites), the resort era, and the early development of the park. Isle Royale's oldest standing structure is the 1855 Rock Harbor Lighthouse. Presently, only the Edisen Fishery, Rock Harbor Lighthouse, and Johns Hotel are listed on the National Register of Historic Places. Another approximately 130 structures have been declared eligible for the National Register by the Michigan State Historic Preservation Officer (SHPO).

As mentioned above, Isle Royale was a base for commercial fishing from the late 1830's up to the establishment of the park, and many commercial fishing camps and sites remain – buildings (fish houses, net houses, cabins), docks, and boats are still intact at the fishery sites. With the exception of Washington Harbor, the fishermen who used the camps are gone and the buildings are deteriorating rapidly.

A number of summer cabins on the island are still used by life leaseholders. When the federal government acquired land for the new park in the 1930's, landowners were given the opportunity to sell their land and extant structures while assuring continued access through a life lease agreement. These leases are active as long as the original leaseholders, or their children born before the leases were signed, are still alive. Ten life leases exist, most of them in Tobin Harbor.

Many administrative facilities, some dating from the CCC and early park period, are over 50 years old. Most have been altered for park use.

Four lighthouses lie within park boundaries. Rock Harbor Lighthouse (1855), a National Register-listed building, is owned and maintained by the park. An extensive rehabilitation project in the 1980's prepared it for a permanent maritime history museum exhibit. Shoreline erosion is a problem at Rock Harbor Lighthouse and has the potential to affect the integrity of the site and possibly the structure itself, unless controlled. The U.S. Coast Guard (USCG) owns and retains jurisdiction over three other light stations in the park at Passage Island (1882), Rock of Ages (1908), and Menagerie Island (1875). The structures – lighthouses, towers, docks and outbuildings – have suffered from neglect and from non-historic repairs. The USCG is in the process of transferring ownership of the lighthouses to the NPS.

3.2.4 Cultural Objects

Isle Royale's museum collection, housed in a new storage facility in Houghton, contains a good general representation of the island's cultural resources (NPS, 1998). The cultural collection is made up of a large variety of shipwreck artifacts, commercial fishing gear and household goods, summer home items, archives, and archeological objects. The archeological collection is very large, estimated at nearly 75,000 items.

The Isle Royale history collection contains the bulk of the objects stored at the park, consisting mostly of commercial fishing gear, household goods, books, maps, park records and artifacts from summer homes. There is also a small archives collection.

3.2.5 Cultural Landscapes

Cultural landscapes are broadly defined as geographic areas that include both natural and cultural resources, and the wildlife or domestic animals therein that are associated with a historical event, activity, or person, or that exhibit either cultural or aesthetic values. The cultural landscape program at Isle Royale is new. Currently, only the Edisen Fishery, Rock Harbor Lighthouse, Barnum/Washington Island, Fisherman's Home, and Crystal Cove have been identified as cultural landscapes, but a number of areas have the potential for cultural significance. The other three lighthouse sites (Passage Island, Isle Royale Lighthouse, and Rock of Ages Light) need to be evaluated for such.

Historic mining sites hold the potential for cultural significance. Mine shafts, rock piles, dams, roads and tramway remains, and partial structures are in evidence at Minong Mine, Island Mine, Siskowit Mine, Wendigo Mine and Todd Harbor's Haytown mine site.

In the 1920's and 1930's, a thriving fishing community of over 20 families lived in Washington Harbor. The harbor and its extant structures need evaluation to determine the appropriate management strategy. Crystal Cove at the northeast end of Amygdaloid Island and Fisherman's Home on the south shore of Isle Royale are the most intact and have the most historical integrity of all the remaining commercial fishing sites. At several of the commercial fishery sites, surviving plants like domestic flowers still attest to past human habitation.

Summer cottages at ten life leaseholdings still exist and are worthy of evaluation as cultural landscapes. The era in which they were built was a vibrant part of Isle Royale's history. Many life-lessees were involved in the movement to create Isle Royale National Park (Little, 1978). The Tobin Harbor life lease community as a whole has the potential to be documented as a cultural landscape.

3.2.6 Ethnographic Resources

Ethnographic resources include prehistoric, historic and contemporary places (sites, structures, and landscapes), objects, fauna, as well as natural resources like rivers, watersheds, and plant species or ethnobotanic species. At present, Isle Royale's information base on its ethnographic resources is quite limited (NPS, 1998). Few ethnographic resources have been identified. Only the culture of the commercial fishing residents of the first half of the 20th century has been documented to some extent. Many of the fishers at that time were of Scandinavian ancestry. Through a vernacular boat study of boat-building traditions of these fishers, related information about their cultural patterns and use of the island is being collected.

It is possible the Ojibwa of the Lake Superior north shore may still use the island's natural resources for sacred and/or ceremonial purposes, although park staff have no knowledge or evidence of current use by present-day Ojibwa and very little documentation of their historic use.

NPS has data on 404 plant species used historically and currently by Chippewa Indians. At present, the occurrence and distribution of these species on Isle Royale is unknown. The contemporary importance of specific plants from this list to affiliated tribes is also not known at this time.

Ethnographic resources include plants and animals traditionally used by native peoples as well as sites and landscapes of ceremonial, medicinal, or other cultural significance to native peoples. Known examples include sugar maple, used for sugar production, and pearly everlasting, used for medicinal purposes. Due to traditional concerns for privacy, it is likely that additional ethnographic resources exist in the park, but have not been made known to NPS staff.

3.3 SOCIAL AND ECONOMIC ENVIRONMENT

3.3.1 Human Health and Safety

At a wilderness park like Isle Royale, backcountry hiking, paddling, and boating entail unavoidable risk (DuFresne, 1991). Weather conditions can change unpredictably from day to day and even hour to hour. The park's Division of Ranger Activities and Resource Management is responsible for search and rescue and emergency medical services.

The smoke, heat and flames from forest fires can threaten human lives and health, both of the public at large and firefighters in particular. Although fires are a natural part of the Isle Royale National Park ecosystem, they have not been part of the typical visitor experience since the park's inception because of infrequent occurrence and past suppression policies. But in general, the smoke and flames associated with wildland fires can be extremely hazardous and it is the park's policy that assuring visitor safety will take priority over fire suppression and monitoring activities. Furthermore, employees responsible for wildland fire management are never to subordinate human lives to other values.

Most visitor use at Isle Royale occurs along shorelines near developed areas and campsites. Only one campground (Island Mine) is not located on a shoreline. All use of concession facilities, life leases, fisheries, park residences and administrative facilities (except lookout towers) is also concentrated along shorelines. The park's trail network of hiking trails is used by two-thirds of visitors (ISRO, 2001); the most heavily used trails are in the Rock Harbor corridor, along a shoreline.

Opportunities for visitors and residents to escape a large, fast-moving fire may be limited along trails away from shorelines. For those using facilities and trails along shorelines, opportunities for escape into or onto the water are readily available.

Isle Royale's 1992 FMP outlines a number of safety procedures and precautions that staff shall follow in the event of wildland fire use, prescribed fires, or unwanted wildland fires. These include public notification efforts inside and outside the park, determining the proximity of potentially vulnerable parties, aiding in evacuation if necessary, and limiting or curtailing visitor use and government activities when fire danger is high.

3.4 PARK FACILITIES & OPERATIONS, VISITOR USE & EXPERIENCE

3.4.1 Park Facilities & Operations

Isle Royale has a visitor center in its administrative headquarters in Houghton, MI, at the point of embarkation on the *Ranger III* park boat that carries visitors across Lake Superior to Isle Royale. Within the park proper, Rock Harbor, near the northeast terminus of Isle Royale (Figure 1.0-2), contains a number of visitor facilities, including a dock, gas pumps, store, restrooms, ranger station, contact center, campground, auditorium, and lodging facilities. A concessionaire operates 20 housekeeping cabins, 60 motel units, restaurant, public showers, and other facilities at Rock Harbor. Full service operations run from about June 10 to September 7 every year. The concession company employs about 60 workers during peak summer season, most of whom are housed in a large dormitory (NPS, 1998).

The Windigo ranger station and visitor center are located near the southwestern end of Isle Royale. Facilities here include a dock, campground, restrooms, general store and amphitheatre. A concession company operates the general store as well as showers, laundry, and limited canoe and small boat rentals. There are no overnight accommodations available at Windigo.

A limited number of other visitor facilities are available at Daisy Farm, Edisen Fishery, the Malone Bay Ranger Station, and Amygdaloid Ranger Station.

The park's summer headquarters are on Mott Island, about four miles southwest of Rock Harbor. Mott Island facilities include a boat repair/carpenter shop, warehouse/maintenance building, central office building, generator powerhouse, bulk fuel storage tanks, water treatment facility, and employee housing (duplexes, single-family houses, and dormitories). Most park operations are conducted or supported by employees living and working at Mott Island. NPS facilities are also located at Malone Bay, Amygdaloid Island, Windigo and Rock Harbor. Both Windigo and Rock Harbor have a generator powerhouse, bulk fuel storage tanks, water treatment facility and employee housing.

Isle Royale's network of about 20 hiking trails is approximately 165 miles in total length (DuFresne, 1991). The trails include 14,000 maintained erosion control devices, six miles of bridging, and 160 trail signs. Trail maintenance is conducted by a seasonal trail crew supplemented by several volunteer groups. Insufficient maintenance has led to increased erosion and development of informal, unauthorized trails.

The park has 70 boat docks that vary considerably in size; two-thirds are available for use by visitors. Almost half of them are associated with campgrounds along the Lake Superior shore. Most of the docks are more than 30 years old and need significant repair or replacement. Isle Royale's marine operations depend on its fleet of 33 boats, which range from 16 to 33 feet in length.

Isle Royale contains 36 campgrounds, over half of which are located along the Lake Superior shoreline (DuFresne, 1991). These campgrounds include a total of 90 pit toilets, 88 shelters, and

112 individual tent sites. Slightly less than half of the campgrounds contain group campsites, for which reservations are required.

Isle Royale's Superintendent is responsible for overall management and operation of the park. Park operations are organized into three divisions: Administration, Maintenance, and Ranger Activities and Resource Management. The Division of Ranger Activities and Resource Management carries out programs that include natural resources management (including wildland fire management), emergency services, scuba diving, law enforcement, concessions management, interpretation and visitor services, environmental education, fee collection, *Ranger III* and group camping reservations, and cultural resources management. The park as a whole is allotted approximately 56 FTE's (Full Time Equivalency positions), of which about 19 are for natural resources management, cultural resources management, interpretation, law enforcement / emergency services, and ranger activities and concession management.

3.4.2 Visitor Use & Experience

Annual visitation to Isle Royale National Park (i.e. the island itself) is shown in Table 3.4.2-1. While there have been gentle fluctuations in park attendance, overall visitation has remained relatively stable over the last two decades. The number of visitors to Isle Royale doubled in the decade of the 1960's, but since 1970 has changed comparatively little. While modest, multi-year fluctuations in visitation are evident in the table below, there is no clear trend over time.

Table 3.4.2-1 – Annual Visitation to Isle Royale National Park, 1981-2000

Year	Number of Visitors	Year	Number of Visitors
1981	14,564	1991	16,468
1982	13,250	1992	16,751
1983	12,973	1993	16,625
1984	11,608	1994	18,725
1985	12,951	1995	18,488
1986	12,788	1996	17,122
1987	15,215	1997	15,409
1988	13,951	1998	16,709
1989	15,824	1999	16,809
1990	16,258	2000	15,602

Source: ISRO, 2000

Weather and ice conditions on Lake Superior largely dictate when visitors and park staff are able to arrive and depart. The park is only open from April 16 through November 1, but visitation is highly concentrated in the summer months. In 1997, almost two-thirds of the visitation took place in July and August.

The number of overnight stays is another useful indicator of park use. Table 3.4.2-2 displays overnight use figures for Isle Royale from 1981-2000. From the late 1980's until 1996, the

number of overnight stays gradually rose; after 1996 it dipped. In 1996, the average length of stay in the park for overnight users and day users combined was 4.1 days.

Almost 70 percent of the overnight stays in 1996 were in Isle Royale's backcountry. Approximately 12 percent of overnight visitors stayed at concession-provided lodging and another 12 percent at the Rock Harbor and Windigo campgrounds.

Two-thirds of all park visitors arrive via one of three commercial transportation services or on the NPS-operated *Ranger III*. The remainder use private boats. Activities in the park largely center around its natural environment and wilderness character. Hiking, backpacking, fishing, canoeing, boating, sailing, kayaking, diving, and observing and enjoying nature are all popular pursuits. Many visitors are also interested in Isle Royale's cultural resources and human history.

Table 3.4.2-2 – Overnight Stays at Isle Royale National Park, 1981-2000

Year	Total Overnight Stays	Year	Total Overnight Stays
1981	57,063	1991	56,867
1982	54,846	1992	57,638
1983	52,805	1993	59,716
1984	49,819	1994	63,444
1985	53,189	1995	65,799
1986	56,136	1996	69,348
1987	53,089	1997	61,600
1988	52,030	1998	63,952
1989	53,525	1999	64,015
1990	56,304	2000	60,655

Source: ISRO, 2000

Like most visitors to national parks, Isle Royale's visitors tend to be highly educated and travel in family or peer groups of two to four people (NPS, 1998). They differ from visitors to other national parks in that more of them have greater experience in backcountry settings, place a higher value on wilderness attributes, and stay longer.

Chapter 4
ENVIRONMENTAL CONSEQUENCES

This chapter provides an analysis of the potential environmental effects of implementing each of the five alternative fire management plans described in Chapter Two. Each of the resource areas whose affected environment was described in Chapter Three is addressed here.

The NPS established a study team to conduct this environmental assessment. The team consisted of Jack Oelfke, Pat Valencia, and Liz Valencia of Isle Royale National Park, Dave Soleim (the Area Fire Management Officer) and Leon Kolankiewicz, a consultant with the Mangi Environmental Group, Inc. The study team conducted the investigation and analyses by gathering the data they concluded were relevant for each resource area. Using these data, the team determined which impacts would occur and assessed them according to their duration, extent, intensity, and whether or not the impact would cause an impairment of Isle Royale National Park's resources. These parameters are defined below. Potential mitigation measures were also identified and analyzed to reduce or avoid potential adverse impacts resulting from the Proposed Action (see Section 2.7 of this EA).

Under each resource area, the impacts of the No Action alternative (Alternative 1, implementation of the 1992 FMP) are first discussed. Each of the four other alternatives, including the Preferred Alternative, is then compared to the No Action alternative in turn.

4.1 DEFINITIONS

Duration of Impact:

Temporary – Impact would only occur simultaneous with the fire, management action or suppression activity. Once the fire, action, or activity has ended, resource conditions are likely to return to pre-activity conditions.

Short-term – Impact would extend beyond the fire, management action or suppression activity, but would last at most a couple of years.

Long-term – Impact would extend well beyond the fire, management action or suppression activity, and would likely last a decade or more.

Extent of Impact:

Localized – Impact would affect the resource only at site of the fire, management action or suppression activity, or its immediate surroundings, and would not extend into the park at large, or the region outside the park.

Regional – Impact would affect the resource on a regional level, extending well past the immediate location of the fire, management action or suppression activity, and spreading into substantial portions of the park and/or areas beyond its boundary.

Intensity of Impact:

Negligible – Minimal or no impact on the resource.

Minor – Change in a resource area occurs, but no substantial resource impact results.

Moderate – Noticeable change in a resource occurs, but the integrity of the resource remains intact.

Major – Substantial impact or change in a resource area that is easily defined, noticeable, and measurable.

As a point of clarification at the outset, under many impact topics and alternatives, the analysis distinguishes between impacts in any one typical year, or during and following any one typical fire or suppression action, from those *long-term* impacts that are likely to follow from a given approach to fire management. In a typical year or during and immediately after a typical fire or suppression action, impacts may well be localized. But over the long term, a much greater area is likely to eventually burn or be subject to a suppression action, so that the same alternative may be rated as having regional effects.

4.1.1 Impairment of Park Resources

The study team analyzed whether impacts would result in an impairment of park resources based on guidelines set forth in NPS Management Policies. Impairment occurs when an impact degrades or harms the integrity of park resources or values, including opportunities that would otherwise normally be available for the enjoyment of those resources or values had the impact not occurred. Under the NPS Organic Act and the General Authorities Act, impairment of park resources is prohibited.

NPS Management Policies outline the conditions under which an impact would be likely to result in an impairment of park resources (NPS, 2000). According to the Policies, an impact would likely create an impairment to the extent that the conservation of the affected resource or value is: 1) essential to fulfill a purpose established in the enabling legislation or proclamation of the park; 2) key to the integrity (natural or cultural) of the park or its opportunities, or 3) identified as a goal in the General Management Plan for the park (NPS, 2000, Section 1.4.5). If an impact is an unavoidable result of an action required to maintain or restore the integrity of park resources or values, and cannot be reasonably mitigated, the impact would be less likely to constitute an impairment of park resources.

4.1.2 Cumulative Impacts

A cumulative impact is an impact on the natural or human environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency, organization, or person undertakes such other actions (40 CFR 1508.7). Cumulative impacts can result from individually minor and insignificant, but collectively significant actions, taking place over a period of time.

Cumulative impacts were assessed by combining the potential environmental impacts of the alternatives with the potential impacts of known projects or activities occurring or projected to occur within the region of the Proposed Action. The most important relevant activity that will be taking place in the foreseeable future across the Boundary Waters region is an increase in the rate of prescribed fire on state, federal, and tribal lands as a method of habitat management and reducing the hazardous buildup of fuels.

4.2 NATURAL RESOURCES

4.2.1 Geology and Soils

Methodology for Assessing Impacts

Soil impacts were qualitatively assessed using literature review, professional judgment, and experience with comparable actions. There will be no impairment of geologic or soil resources or related values at Isle Royale National Park as a result of the implementation of any of the alternatives.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Alternative 1 will have a negligible impact on the park's geologic features and values. It will likely have long-term, localized, negligible to minor impacts on soils in the park.

Alternative 1 will lead to a rather limited amount of soil erosion and soil compaction. Soil erosion can occur in two principal ways from wildland fires: fire suppression, and fuel reduction activities. Both ways involve exposing or disturbing soils, especially soils on steeper slopes, to rainfall and runoff. Wildland fires and prescribed fires alike can temporarily eliminate or reduce the protective vegetative cover and burn up duff and litter, thus exposing underlying soils to the direct impact of raindrops and allowing soil particles to be carried away in runoff as suspended sediments. From 1984-2001, only 96 acres in total out of the park's 133,788 acres of terrestrial surface area, or less than one tenth of one percent, were burned from all fires. Disturbed soils on steeper slopes are more vulnerable to runoff, and they tend to be thinner anyway, so damage to soils and the vegetation they support on these sites is longer-lasting.

Fire suppression techniques like constructing firelines down to mineral soil cause even more intensive disruption to the surface soil layer. However, these cover a much smaller area than the

total acreage burned. Moreover, NPS policy requires the use of Minimum Impact Suppression Tactics (MIST), especially in designated Wilderness, which further reduces the area of directly-disturbed ground surface. MIST relevant to protecting soils include the following:

- *Cold trail the fire-edge when practical.*
- *Wetlines, or environmental lines, will be used wherever possible in lieu of handline construction if water and pumps are available. Waterbars will be constructed on handlines on steep slopes.*
- *Utilize soaker hose or foggers in mop-up. Avoid "boring" and hydraulic action on shallow soils.*
- *Firelines will be kept to the minimum width necessary to allow backfiring or safe blackline to be created. Utilize natural barriers wherever possible to avoid "tunnel effect."*
- *If a mineral soil line is needed, utilize fireline explosives whenever possible.*

Another possible impact to soils from suppression activities is compaction, which occurs when heavy objects press down on the ground. Compaction harms soil structure, can decrease permeability and increase runoff, and reduce the ability of soils to support vegetation. However, since heavy equipment like bulldozers and graders would not be used at Isle Royale, this impact, from firefighters themselves and their equipment, would be negligible and localized.

The use of fire retardants and foam suppressants is not expected to result in any appreciable soil contamination. However, since fertilizers are an ingredient of fire retardant chemicals, their application to a site is comparable to the light application of a nitrogen fertilizer (Hamilton et al., no date). Overall, in the context of the park as a whole, this effect will have short-term, localized and negligible to minor effects on soils.

Prescribed fires in the Suppression FMU and the Conditional FMU will benefit soils by returning nutrients stored in ground fuels (Vogl, 1979; Wright and Bailey, 1980), and will lead to short-term, but minor increases in soil erosion. This effect will be localized and site-specific.

Alternative 2 – Modified No Action (*Preferred Alternative*)

This alternative will generate impacts similar to those of Alternative 1, the No Action alternative. Alternative 2 will have a negligible impact on the park's geologic features and values. It will likely, however, generate long-term, localized, minor impacts on soils in the park.

On a year-to-year basis there may be greater impacts on soils with this alternative than in the No Action alternative, because of the potential for expanded use of prescribed fires within the Wildland Fire Use (WFU) FMU. However, these impacts will still be short-term, localized, and minor. Moreover, the expanded use of prescribed fire throughout the Wildland Fire Use FMU will cause rather minimal disturbance to soils on a regular basis, rather than on a less frequent but more destructive basis, as would be the case with waiting for naturally-ignited wildland fires to pass through an area.

MIST will be employed during any suppression activities, reducing impacts to soils from these.

Alternative 3 – Complete Suppression of All Wildland Fires

In this alternative, all lightning-caused and human-caused wildland fires will be suppressed throughout the park. No prescribed fire will be practiced. Alternative 3 will have a negligible impact on the park's geologic features and values. With regard to soils, however, it will likely have long-term, potentially regional, moderate impacts on soils in the park, as a result of infrequent but catastrophic unwanted wildland fires that will eventually occur under this alternative.

In any given "typical" year, the minor amount of erosion that will occur under Alternatives 1 and 2 from prescribed fires will be avoided under Alternative 3. However, there will be a somewhat greater amount of soil disturbance, compaction and erosion associated with the use of firelines in a more active suppression program; these impacts will be reduced to a level of insignificance by the use of MIST, as in Alternatives 1 and 2.

The benefits to soils at burn sites from returning nutrients stored in ground fuels will be largely foregone in this alternative. The fertilizing effect from the use of fire retardant chemicals at the point of their application will be somewhat greater in Alternative 3 than in the No Action alternative, as a result of the more vigorous emphasis on suppression.

On a longer time scale, that of centuries, this alternative will result in rare but catastrophic, unwanted wildland fires as a result of unnatural levels of fuel accumulation. These intense, hot fires can scorch both ground and the forest, leaving large areas of soils unprotected during storm events. Substantial quantities of erosion and soil loss could occur on exposed, steeper slopes under these conditions.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

Under this alternative, the wildland fire use FMU will be expanded to all but the suppression FMU's. Alternative 4 will have a negligible impact on the park's geologic features and values. With regard to soils, however, it will likely have long-term, potentially regional, moderate impacts on soils in the park, as a result of infrequent but intense wildland fires that may periodically occur under the natural fire return interval established by this alternative.

In any given "typical" year, the minor amount of erosion that will occur under Alternatives 1 and 2 from prescribed fires will largely be avoided under Alternative 4. There will also be a somewhat smaller amount of erosion and soil compaction associated with the reduced use of firelines in a more selective suppression program; these impacts will be further reduced by the use of MIST, as in the other altneratives. However, on an infrequent basis, WFU's will potentially burn much larger acreages more intensely than would occur with the regular use of prescribed fires, and these more infrequent fires will likely have more extensive and somewhat more adverse effects on soils.

The benefits to soils at burn sites from occasionally returning nutrients stored in ground fuels will be retained in this alternative, but on a more irregular, less predictable schedule. The fertilizing effect from the use of fire retardant chemicals at the point of their application will be reduced in Alternative 4 from the No Action alternative, as a result of more limited suppression efforts.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Impacts from Alternative 5 would be comparable to those of Alternative 1 (No Action) and Alternative 2 (preferred alternative). Alternative 5 would have a negligible impact on the park's geologic features and values. It would likely, however, generate long-term, localized, minor impacts on soils in the park. The overall effect of this alternative would be to disturb soils on a given site on a more frequent, regular basis than in Alternatives 1 - 4, but to a smaller extent.

Cumulative Impacts

There are no other reasonably foreseeable actions affecting the park's geology and soils in the future, to which the impacts of these alternatives would be added. None of the alternatives discussed above will be likely to result in or contribute to adverse, cumulative impacts, such as soil degradation or disappearance, over the short or long term. Soil formation processes will continue to take place under each alternative, so that soils are regenerated adequately.

Conclusion

The FMP alternatives discussed above will have impacts on the park's soils ranging from negligible to moderate. Their extent varies from localized to regional. Each alternative will involve some degree of disturbance of the park's soils; the primary distinction between the alternatives is regular, smaller disturbances on a shorter time scale vs. irregular, less frequent but more destructive disturbances.

In summary then, the implementation of any of the alternatives will not impair geologic and soil resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan (GMP) or other National Park Service (NPS) planning documents.

4.2.2 Water Resources

Methodology for Assessing Impacts

The study team qualitatively assessed impacts to water resources by means of reviewing literature and applying professional judgment and experience with water resources (quality and quantity) to the particular hydrologic conditions of Isle Royale National Park. There will be no impairment of water resources in the park as a result implementing any of the alternatives.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Implementing Alternative 1 will produce long-term, localized, minor impacts on waters in the park. Impacts from any one wildland fire, prescribed fire, or suppression effort on water quality will tend to be short-term, localized and minor to moderate in intensity.

The two principal impacts to water quality stem from: 1) erosion-induced suspended sediments, turbidity, and sedimentation, and 2) toxic effects from fire retardants and foam suppressants. In addition, intense fires may introduce large quantities of organic material (ash) into aquatic systems, blown in by wind or transported by runoff.

Increased soil erosion can result from loss of vegetative cover during a fire as well as from ground crews engaged in suppression activities. These could lead to turbidity and sedimentation of surface water resources in the park, both in streams and lakes. Turbidity and sedimentation can alter the hydrologic regime of surface waters and adversely impact aquatic habitats, invertebrates and fish. Diligent adherence to MIST as discussed under Section 4.2.1 above will reduce water quality problems from suppression efforts. However, a large, intense fire – which has a small but non-zero possibility of occurring in any one year under this alternative – has a high probability of resulting in short-term, localized, moderate to major adverse impacts on water quality from erosion, turbidity and sedimentation.

The use of fire retardants and/or foams could potentially cause significant temporary to short-term impacts to water quality and aquatic life if misapplied or mishandled (USDA Forest Service, 2000a). Retardants contain ammonia and phosphate or sulfate ions, which can change the chemistry of a water body, thus making it temporarily lethal to fish and other aquatic organisms; the principal toxic component of retardant chemicals in aquatic systems is ammonia (Adams and Simmons, 1999) Foams contain detergents that can interfere with the ability of fish gills to absorb oxygen. The degree of impact would depend on the volume of retardant/foam dropped into the water body, the size of the water body, and the volume of flow in the stream or river. For example, if a 800-gallon drop is made into a fast flowing river, it is likely that the lethal effects to aquatic resources will be short-lived as dilution below the toxic level is quickly achieved. On the other hand, a 3,000-gallon drop in a stagnant pond would likely cause toxic levels to persist for some time (USDA Forest Service, 2001).

After an extensive review of the literature, the USEPA published a regulation (40 CFR Ch. 1 (122.27 – 122.3) regulation that deemed the use of retardants and foam suppressants in firefighting as a Cataclysmic Release. This ruling views their use as a necessary tradeoff in order to prevent the greater destruction of aquatic ecosystems from fire-caused silting, suspended solids and pH changes, than the possible loss of fish from an inadvertent retardant drop into a water body (USDA Forest Service, 2000a). The USEPA Office of the General Council reviewed this ruling and concurred that fire retardants and foams are neither subject to Point Source Regulations nor the National Pollution Discharge Elimination System (NPDES) procedures under the Federal Clean Water Act. Nevertheless, scientific studies state unequivocally that direct application of fire retardant to waterways should be avoided.

Therefore, this alternative (and all of the others) incorporates the following special restrictions with regard to aerially applied retardant and foam use:

> ***Retardant*** *– No retardant drops within 400 feet of open water.*
>
> ***Foam (aerial delivery)*** *– Aerial delivery of foam requires Park Superintendent approval on a case-by-case basis. When approved, the following guidelines apply:*

- *Foam concentrate will only be injected into the holding tank after the water pick-up operation has been completed.*
- *Drops from Beaver, T2 & T3 helicopters – no drops within 200 feet of open water.*
- *Drops from Scoopers, heavy air tanker or heavy helicopter – no drops within 400 feet of open water.*

Foam (ground delivery with motorized pumps):

- *No application within 25 feet of open water when using small pumps.*
- *No application within 50 feet of open water when using Mk III or equivalent pumps.*
- *All foam concentrate used for injection will be located in impermeable containment basins, i.e. visqueen (plastic sheet) spread over rocks or logs to form a catch basin.*

Foam (ground delivery with backpack pumps):

- *No application within 10 feet of open water.*
- *All backpack pumps will be filled a minimum of 10 feet from open water. A separate, uncontaminated container must be used to transport water from source to backpack pump. This container must be kept uncontaminated by concentrate.*

Diligent adherence to these measures will reduce the chance of adverse effects on water quality from the use of chemicals to suppress fires. However, there always exists the possibility of an accidental spill or aerial delivery of fire retardant, foam suppressant, or other hazardous material such as gasoline, directly into water bodies.

Another short-term impact of fires, particularly severe ones, on water quantity as well as quality is likely to be increasing the peak of the hydrograph within a given fire-impacted watershed until vegetative cover is able to re-establish itself. That is, the pulse of water flow through the hydrologic system will increase, as a result of decreased infiltration and absorption of rainfall into duff, litter and soil. Therefore, the runoff rate increases. This greater volume and velocity of flowing waters could potentially cause some scouring in streams and a temporary to short-term increase in turbidity and sedimentation.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Impacts of this alternative on water resources will be comparable to those of Alternatives 1. Implementing Alternative 2 will produce long-term, localized, minor impacts on waters in the park. Impacts from any one prescribed fire on water quality will tend to be short-term, localized and negligible to minor in intensity. Impacts from any one wildland fire or suppression effort on water quality will tend to be short-term, localized and minor to moderate in intensity.

Alternative 2 will likely differ from the No Action alternative by inducing more localized, negligible to minor impacts on water quality in any given year from a greater rate of prescribed fire. However, this will thereby avoid somewhat larger or more intensive impacts on water quality that are likely to occur when larger, more severe wildland fires with greater fuels to consume sweep across the park landscape, as under Alternatives 1, 3 and 4.

Alternative 3 – Complete Suppression of All Wildland Fires

In a typical year, implementing Alternative 3 will produce long-term, localized, minor impacts on waters in the park. Impacts from any one wildland fire or suppression effort on water quality will tend to be short-term, localized and minor to moderate in intensity. However, as a result of infrequent but catastrophic, unwanted wildland fires that will almost inevitably occur under this alternative, over a period of time ranging from multiple decades to centuries, impacts to water quality will be short-term, regional, and moderate to major in intensity.

In comparison with Alternative 1, since all wildland fires will be suppressed and no prescribed fire will be undertaken, there will be less impact to water quality from loss of vegetation cover and subsequent erosion, runoff, and turbidity. However, greater quantities of fire retardants and suppressants will be used in this alternative, especially during occasional large unwanted wildland fire suppression efforts, increasing the risk of temporary toxic impacts to water quality and aquatic life.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

In general, implementing Alternative 4 will result in long-term, localized to regional, minor to moderate impacts on waters in the park. Impacts from any one wildland fire or suppression effort on water quality will tend to be short-term, localized and minor to moderate in intensity.

This alternative is similar in its impacts on water quality to Alternative 1, the No Action alternative, in that the same approach to wildland fires, prescribed fires, and fire suppression will be practiced on more than 90 percent of the park's land area. The same mitigation measures will be utilized with regard to the use of fire retardants and suppressants.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Impacts of this alternative on water resources would be roughly comparable to those of Alternatives 1 and 4. Implementing Alternative 5 would generate long-term, localized, negligible to minor impacts on waters in the park. Impacts from any one prescribed fire or suppression effort on water quality would tend to be short-term, localized and negligible to minor in intensity.

Like Alternative 2, but even more so, Alternative 5 would likely differ from the No Action alternative (and even more so from Alternative 3) by inducing more localized, minor impacts on water quality in any given year due to a more intensive program of prescribed burning across more of the park. However, this would thereby avoid somewhat more widespread and/or more severe impacts on water quality that are likely to occur when larger, more severe wildland fires with greater quantities of fuels to consume sweep across the park landscape, as under Alternatives 3 and 4.

Cumulative Impacts

As discussed in Chapter 3, in Section 3.1.3, water quality in the park is now, and has been for many years, subject to several internal and external influences that, in sum, have led to a certain degree of

degradation in various water quality parameters (as well as excessive concentrations of toxins in related media like sediments and fish flesh). In spite of these deleterious influences, overall, Isle Royale's water quality remains quite good. The five alternatives are not likely to contribute to significantly adverse cumulative impacts on the park's water quality.

Conclusion

Each of the FMP alternatives discussed above will have impacts on the park's water resources, more so on water quality than water quantity (hydrology and flow patterns). Both fires and suppression actions will potentially affect water quality, the former from erosion and turbidity due to loss of vegetative cover, the latter from soil disturbance and possible temporary to short-term toxic effects of firefighting chemicals (retardants and foams) if dropped inadvertently into streams or lakes.

These impacts will range from negligible to moderate in intensity; in the case of any given fire or suppression action, they will tend to be short-term and localized. Looking at the park as a whole, these impacts will be long-term, but dispersed over time and throughout the park's surface waters. The impact of any given prescribed fire is likely to be temporary to short-term, localized and negligible to minor. Larger wildland fires can both affect more surface waters and affect them more negatively.

By attempting to suppress all fires, Alternative 3 will avoid relatively small year-to-year effects on water quality from prescribed fires and WFU, but at the cost of rare but devastating fires that will have a much more severe, potentially regional, and longer-lasting impact on water quality, aquatic habitat, and aquatic organisms from severe erosion, turbidity and sedimentation. Nevertheless, none of the alternatives will permanently impair the park's water resources.

In summary then, the implementation of any of the alternatives will not impair water resources or values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's GMP or other NPS planning documents.

4.2.3 Floodplains and Wetlands

Methodology for Assessing Impacts

The study team qualitatively assessed impacts to floodplains and wetlands by examining the hydrologic features and processes of the park, the distribution of streamcourses, developed areas, lakes, and wetlands, and comparing these with the predicted effects of wildland and prescribed fires, fire management activities, and fire suppression efforts. There will be no impairment of floodplains and wetlands in Isle Royale National Park from implementing any of the alternatives.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Alternative 1 will result in generally negligible to minor impacts on floodplains and wetlands in the park. As indicated in the previous two sections, fires, especially large, intense fires, can increase the

rate of runoff by stripping vegetative cover and disturbing soils. This in turn can raise the peak of the hydrograph of streams in affected watersheds, that is, increasing the volume and velocity of waters flowing in streams during and immediately after storm events. This pulse of water can then produce some level of flooding, scouring, streambank erosion, and sedimentation.

However, by allowing wildland fire use and a limited amount of prescribed fires (especially in the Suppression and Conditional FMU's), Alternative 1 generally will not permit the buildup of fuels that could eventually lead to catastrophic blazes. In any case, most of the streams in the park are in wild areas that lack development downstream that could be damaged by flooding.

Wetlands such as interior marshes, bogs, and margins of lakes located downstream of infrequent, large, severe fires – which this Alternative at least partially attempts to avoid – could potentially be altered as a result of sediment deposition. Such deposition could smother certain emergent plants and alter the character of the marsh for some time, even filling it in.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Alternative 2 will have effects on floodplains and wetlands largely comparable to those of Alternative 1 – generally negligible to minor. Through greater use of prescribed fire, these effects will probably be more dispersed through time rather than concentrated in the immediate aftermath of a large, severe fire (which has a greater chance of happening in Alternative 1 than Alternative 2).

Alternative 3 – Complete Suppression of All Wildland Fires

In a typical year, implementing Alternative 3 will lead to negligible impacts on floodplains and wetlands. However, infrequent but destructive, unwanted wildland fires will almost certainly occur under this alternative, consuming fuels that will have accumulated over many decades. When this does occur, there is likely to be substantial flooding, more than in Alternatives 1 and 2, in those watersheds that have burned. Nevertheless, with the general absence of downstream developments within floodplains of the park, there is little property, infrastructure or improvements to be damaged by this eventuality.

Infrequent but highly destructive unwanted wildland fires could adversely affect downstream wetlands over the short-term to long-term by means of sedimentation. The likelihood of this occurring at any given marsh in any given year is negligible, but over long enough periods of time, under this scenario, it is highly probable.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

Overall, impacts to floodplains and wetlands from this alternative, as with Alternative 1, will be generally negligible to minor. The natural fire return interval that would be counted on in the wildland fire use unit will result in fewer but somewhat larger fires with correspondingly greater effects on water flows through affected floodplains. Nevertheless, such flows will not generally affect developed areas in downstream floodplains, since this unit is largely consists of undeveloped wilderness areas.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Alternative 5 would also have effects on floodplains and wetland functions and values largely comparable to those of Alternative 1, 2 and 4 – generally negligible to minor. Through greater use of prescribed burning than even in Alternative 2, these effects would probably be more dispersed through time rather than concentrated in the immediate aftermath of a large, severe fire (which has a greater chance of happening under Alternative 1 than Alternative 5).

Cumulative Impacts

No other reasonably foreseeable, future projects within the park or outside its borders upstream are known that will combine with any of the five above alternatives to generate significant cumulative impacts on floodplains and wetlands.

Conclusion

Impacts to floodplains and wetlands from each of the five alternatives will generally be negligible to minor. Under Alternative 3, rare but severe fires could lead to equally rare but potentially damaging flooding, although most of this will not damage property or costly improvements due to the remote, undeveloped nature of most floodplains.

Implementation of any of the alternatives will not impair floodplains and wetlands or values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's GMP or other NPS planning documents.

4.2.4 Air Quality

Methodology for Assessing Impacts

Impacts to air quality were qualitatively assessed by means of a review of the literature and pertinent laws, guidance and regulations, consultation with experts and regulators, professional judgment, and experience with comparable actions. While there will be some adverse effects on air quality from implementing each of the alternatives below, only Alternative 3 (Complete Suppression of All Wildland Fires) may on occasion lead to an impairment of air quality at Isle Royale National Park.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

In a typical year, Alternative 1 will result in short-term, regional, negligible to minor adverse impacts on air quality. With prescribed fire occurring occasionally for the indefinite future, and wildland fire use and uwanted wildland fires occurring in most years, impacts to air quality could also be judged as long-term. Since large, severe fires may occasionally occur under this alternative on a time frame ranging from multiple decades to centuries, at these times Alternative 1 could result in temporary, major impacts on regional air quality.

As discussed in Section 3.1.5, wildland fires produce various chemical compounds. These compounds include nitrogen oxides (NOx), organic compounds, carbon monoxide, and particulate matter (PM) or small particles. The pollutants released by fires that most affect visibility are PM_{10}, $PM_{2.5}$ (particulate matter 10 and 2.5 microns in diameter, respectively), nitrates, ozone, organic carbon, and elemental carbon. Ozone, a corrosive constituent of "smog" or haze, is not directly produced by fires, but from chemical reactions between other combustion products (NOx and volatile organic compounds or VOCs). About 90 percent of smoke particles from wildland and prescribed fires are PM_{10} and about 70 percent are $PM_{2.5}$ (MNICS, 2001). Another toxic pollutant released in trace amounts by forest fires into the air is dioxin (Gossman Consulting, no date), a family of chemical compounds that scientific studies have shown can cause a number of adverse health effects (USDA FSIS, 1999). Among other things, dioxins are known endocrine disrupters (EMS, 2001); in humans, heart disease, cancer, and increased risk of diabetes have also been linked to dioxin (NIEHS, 2001). Dioxins deposited in the environment can be taken up by plants and then animals and aquatic organisms, growing more concentrated as they ascend the food chain (a phenomenon known as "biomagnification") so that animals, especially carnivores, have higher concentrations than herbivores, plants, water, soil, or sediments. Within animals, dioxins tend to accumulate in fat. Food accounts for 95 percent of human exposure to dioxin (TRI, no date). However, levels of dioxin in food have been cut in half in recent years as a result of growing awareness and regulation.

Isle Royale National Park's prescribed fire program is too small to generate significant dioxin emissions. The presence of dioxins and other synthetic organic chemicals and heavy metals released by human activity near and far into the park environment is certainly a source of concern and merits long-term monitoring. However, at present, there is no research that would indicate that dioxin concentrations in the Isle Royale environment are high enough to be having a detrimental effect on wildlife populations. For example, the bald eagle and the osprey, two fish-feeding raptors at the top of the food chain (and therefore most susceptible to bioaccumulation), have been increasing in the park over the last couple of decades.

Under the current and prior FMP's, approximately 96 acres in total burned from 1984 through the 2001 fire season, averaging (with substantial variation from year to year) roughly five acres burned per year in WFU, prescribed fires, and unwanted wildland fires combined. Since the park is still in attainment of the National Ambient Air Quality Standards (NAAQSA) and is rated "good" on visibility, this level of burning appears compatible with maintaining acceptable air quality. Projecting this rate of burning and associated emissions into the future, Alternative 1's impacts thus appear to be negligible to minor in intensity. However, USEPA's regional haze regulations, issued under 1977 and 1990 amendments to the Clean Air Act, require not just maintenance of air quality in the 156 mandatory Class I areas, but improvement (USEPA, 1999).

Michigan does not have specific visibility regulations, and its air pollution rules that relate to fire are aimed at protecting the public from the nuisance of smoke as much as the health or aesthetic effects. Isle Royale does not require a burn permit from the Michigan Department of Natural Resources (MDNR) in order to conduct prescribed fires because of the park's remoteness (Wilson, 2002). MDNR's open burning regulations (http://www.dnr.state.mi.us/pdfs/forestry/airrule.htm) permit the burning of "trees, logs, brush, and stumps..." in remote areas such as Isle Royale

provided the fire does not become a nuisance. Due to the distance of Isle Royale to any portion of Michigan (or Minnesota), the likelihood of this occurring is negligible.

The Michigan Department of Environmental Quality (MDEQ) has requested that the National Park Service contact the Air Quality District Supervisor in Marquette, Michigan if a fire use fire or unwanted wildland fire is of sufficient size or smoke generation resulting in health concerns to the public, nuisance complaints, or media interest (Fitzner, 2002).

Within the park, developed areas at Mott Island, Rock Harbor, and Windigo commonly have between 50 and several hundred people in residence. Other potentially sensitive receptors are campgrounds, ranger stations, life lessee and fishery cabins. The most sensitive receptors in the park would be the concession facility at Rock Harbor and the cluster of life lessees in Tobin Harbor.

Any or all of these targets could be affected by smoke produced from fires at Isle Royale, although past history suggests that the frequency of smoke events is extremely low. Areas most likely to be impacted by smoke are those within a thirty-degree radius of the path of any smoke plume and within the specified distances for the type and size of the fire. Critical targets of special concern are those that are within 3/4 of a mile of the plume.

Most of the problems associated with fire emissions are caused by particulates. At Isle Royale, smoke which remains near the ground from a smoldering fire is more likely to be a problem than the interception of smoke plumes. Drainages and valleys (e.g. Tobin Harbor) concentrate smoke at night, and smoke particles may serve as the nuclei for fog development (NWCG, 1985). Smoke-generated fog may be uncomfortable, but it should not cause any dangerous visibility problems since there are no roads in the park and boaters are accustomed to navigating in fog at Isle Royale. Advisories will be made via marine radio if necessary.

In order to mitigate the effects of wildland fire use, prescribed fires, and wildland fires managed with fire suppression actions, for this alternative, and each of the others as well, Isle Royale will implement the mitigation measures described in Section 2.8.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Alternative 2 will have impacts more or less equivalent to those of Alternative 1. In a typical year, it will result in short-term, regional, minor to moderate adverse impacts on air quality. By expanding the use of prescribed fire, and the prescriptions for wildland fire use, this alternative will tend to spread smoke emissions out over more years instead of concentrating them in the years when wildland fire use and unwanted wildland fires are prevalent. It will also reduce the long-term likelihood of severe unwanted wildland fires and the much greater emissions associated with those. Impacts on air quality from any given prescribed fire will likely be temporary, localized and minor.

The mitigation measures cited for Alternative 1 will also be followed in this alternative.

Alternative 3 – Complete Suppression of All Wildland Fires

By not conducting prescribed fires, and by energetically suppressing all wildland fires, in a typical year, Alternative 3 will generate somewhat less smoke and fewer emissions than Alternatives 1 and 2, so that its temporary effects on air quality will be reduced commensurately. Impacts will be temporary, localized, and minor in intensity.

The caveat is that by suppressing all wildland fires over a period of decades, which was the policy of the NPS and other federal agencies during most of the 20th century, the park may be facilitating the accumulation of fuels to extreme levels. Eventually, under extreme weather conditions that will inevitably occur sooner or later, a destructive, unwanted wildland fire that suppression efforts will be unable to control will consume these fuels. When that happens, a major air pollution episode will occur that could last days or weeks, with significant violations of the NAAQS. This could conceivably constitute an impairment of air resources in the park and region.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

In terms of gross emissions of particulates over time, Alternative 4 will have impacts roughly similar to those of Alternative 1, but with more variation from year to year because of its dependence on naturally-ignited wildland fires over almost all of the park. In a typical year, this alternative will produce fewer emissions, and result in short-term, regional, minor adverse impacts on air quality. By using fewer prescribed fires in any given year than Alternative 1, it will avoid lower-level emissions associated with those fires. However, wildland fires will eventually consume accumulated fuels in these areas, and at those times, smoke and emissions will be greater. The tradeoff is between generating smoke and particulate emissions concentrated in time versus having them more dispersed over time. This alternative will lead to more concentrated emissions at particular times when weather conditions are conducive to naturally-ignited wildland fires.

With regard to managing smoke generation from wildland fire use, pertinent mitigation measures cited for Alternative 1 will also be followed in this alternative.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Alternative 5's impacts on air quality would be similar to those of Alternatives 1, 2 and 4, except that emissions would likely be even more dispersed over time due to expanded use of prescribed fire for habitat management and hazard fuel reduction. The long-term probability of a severe, uncontrollable unwanted wildland fire striking the park would be even smaller than in Alternatives 1 and 4, and much smaller than Alternative 3. The same mitigation measures would be fully implemented, with even greater acreages to be subjected to prescribed fires in the future. Impacts on air quality from any given prescribed fire would likely be temporary, localized and minor. Overall, Alternative 5's impacts would tend to be long-term, localized to regional, and minor.

Cumulative Impacts

As mentioned in Section 3.1.5 (Affected Environment section for air quality), evidence suggests some deterioration of visibility and other measures of air quality in recent years. Most of the sources of these pollutants are located outside the park, as in the case of the pulp mill in Thunder Bay, Ontario. It is unknown whether these adverse trends will continue in the future.

In the near future, implementation of a large prescribed fire program at the Boundary Waters Canoe Area Wilderness to the west on the Superior National Forest BWCAW to address hazardous fuel conditions as a result of an enormous 1999 blowdown will add significant quantities of smoke to the regional airshed (SNF, 2001). Under the preferred alternative (#2, modified no action) a moderate increase in Isle Royale National Park's total emissions from some combination of prescribed fires, wildland fire use, and unwanted wildland fires in the coming decades may occur. Thus, the park will contribute incrementally to overall cumulative impacts in the regional airshed that could be rated as moderate to major. It may be difficult to achieve the long-term goal specified in Clean Air Act amendments of actually improving air quality and visibility in this Class I area.

Conclusion

Individual fires, whether prescribed fires, wildland fire use, or unwanted wildland fires, depending on their size and severity, will generate impacts on air quality that range from temporary to short-term, and localized to regional in extent. Their intensity will typically be negligible to minor, with occasional instances of moderate impacts and rare instances of major ones. Impacts on air quality that are "major" in intensity are likely to occur only under Alternative 3, the complete suppression alternative, and even then, perhaps just once a century or less on average. Alternative 2, which may implement an expanded program of prescribed fire, will generate more consistent impacts on air quality from year to year; however, these impacts will generally be temporary, localized and minor. This will be even more true of Alternative 5, which will depend almost exclusively on prescribed fire in managing fuel loads and annual amounts of combustion.

Alternative 4, which emphasizes wildland fire use and excludes prescribed fire, will in most years produce fewer smoke and particulate emissions than Alternatives 1 and 2, but once or more every few decades or so will produce much greater emissions when large fires consume accumulated fuel as one did in 1936. These impacts could be short-term, regional and moderate to major in intensity. Likewise, Alternative 3, which suppresses all fires, will in most years have even fewer emissions. However, as fuels accumulate, extreme weather conditions, perhaps one to several times in a century, will inevitably trigger catastrophic unwanted wildland fires that will have a major impact on regional air quality for up to several months at a time.

In summary then, the implementation of Alternatives 1, 2, 4, and 5 will not impair air resources and related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's GMP or other NPS planning documents.

In contrast, during most years, Alternative 3, because of its lack of prescribed fire and wildland fire use, will actually produce less smoke and thus better air quality and visibility than any of the other alternatives. The tradeoff, however, is perhaps once or several times a century, the full suppression alternative may result in large, severe fires that overwhelm suppression efforts and generate major impacts on air quality and significant air pollution episodes, which may be regarded as an impairment of this resource.

As noted in Chapter 3, research into the park's natural fire regime is now underway. It may shed light on whether the potential for large, destructive fires is significant, or whether the evolution of Isle Royale's vegetation communities, as affected in strong part by moose browsing, makes large, hot fires less likely. It might be that the "spruce-moose-savanna" effect, as well as the virtual elimination of the ladder fuel Canada yew and its replacement with thimbleberry (which does not carry fire well) in the shrub layer may have reduced flammability enough to sharply reduce the probability of large, destructive fires at Isle Royale National Park even under a policy of complete suppression.

4.2.5 Vegetation

Methodology for Assessing Impacts

Impacts to vegetation from the five alternatives were qualitatively assessed by means of a literature review of forest and fire ecology in the region, consultation with foresters, botanists and fire specialists. Only Alternative 3, the complete suppression alternative, may potentially lead to an impairment of the park's vegetation resources.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Over the 10-15 year life of the FMP, Alternative 1 is likely to lead to long-term, regional, minor adverse effects on vegetation communities, as judged by the park's own evaluation of recent trends and successional pathways, which this alternative will perpetuate.

In this alternative, the Wildland Fire Use FMU will continue to cover more than 90 percent of the park. In this FMU, naturally-ignited wildland fires will be emphasized and prescribed fires will play only a very limited role as an agent of disturbance and habitat management. If the recent past is any indication, then within the boreal forest community that covers the northeastern part of the island, the combined effects of generally humid conditions, continued moose browsing, and the dominance of shrub layer plants like thimbleberry, that do not support ground fires except under droughty conditions, are likely to prevent any major natural wildland fires over the next 10-15 years. Birch and aspen stands from the 1936 fire and elsewhere will continue to age, become more decadent, and thin out. Barring a collapse of the moose population, intensive moose browsing is likely to thwart recruitment of aspen, birch, and balsam fir saplings. The boreal forest community may continue its transition toward more open savanna-like conditions. The northern hardwood forest community that dominates the southwestern part of Isle Royale is more likely to remain relatively unchanged over the coming 10-15 years.

As discussed in Section 4.2.2, the use of fire retardants under this (and all other) alternatives during active suppression efforts could have short-term, localized effects on vegetation in the vicinity of a fire as a result of the nitrogen-fertilizing properties of the retardant (Hamilton, et al., no date). If conditions are sufficiently moist, increased growth will likely occur during the growing season in which the chemical is applied, but this effect will not persist. Under drier conditions, there will likely be no increased growth or biomass production. Weedy or exotic species able to exploit the additional nitrogen more effectively may gain a temporary advantage at the expense of more desirable native plants, especially under moist conditions.

Alternative 2 – Modified No Action (*Preferred Alternative*)

By expanding fire prescriptions and allowing for greater use of prescribed fires and wildland fire use (if ongoing research points toward the desirability of re-introducing fire on a greater scale), this alternative will explicitly engage fire for the purpose of habitat management. Based on a growing body of experience in different ecosystems around the country, in general, prescribed fire can manipulate vegetation to produce healthier habitats. Fires tend to provide a pulse of readily available nutrients for plant growth, as well as temporarily improving the quality of that growth for wildlife, including more nutrients and protein and less lignin and crude fiber (Hunter, 1990).

If fully and successfully implemented, its impacts will be long-term, regional, and probably moderately beneficial. However, although park resource management expresses concern about certain ongoing trends in habitat succession, Isle Royale has not yet explicitly identified a target vegetation community. Moreover, given the recent evolution of plant community structure and composition at Isle Royale toward associations that are less responsive to fire, it may be hard to utilize fire to achieve habitat goals.

As with the No Action Alternative, this alternative will not substantially impact the distribution and relative occurrence of the two major biomes on Isle Royale. However, long-term climate change, if it occurs, will take place regardless of whether this alternative is implemented, and is likely to have a much more profound effect on the distribution of the boreal and northern hardwood forest communities.

Alternative 3 – Complete Suppression of All Wildland Fires

Over the 10-15 year life of the FMP, in the absence of a large, uncontrollable fire, Alternative 3 will continue to help shape succession of the park's vegetation in manner similar to that of the No Action Alternative. By actively discouraging reintroduction of fire as a natural ecological force, this alternative's impacts on vegetation communities will be long-term, regional, and moderately adverse.

In this alternative, all fires will be suppressed throughout the park in one large FMU. It is highly likely that, for the foreseeable future (and certainly over the lifetime of this FMP), recent trends in Isle Royale vegetation communities will continue. Given these trends, large, intensive fires may be discouraged by the lack of significant fuel accumulation. It may be possible that a

combination of a low fuel accumulation rate and intensive suppression efforts when needed may succeed in preventing major unwanted wildland fires. However, as noted in other sections, it is equally possible that at least in part of the park, a policy of total suppression will succeed only in postponing the return of fire to the landscape, and will also trigger larger fires that have more fuel to consume.

As with the other alternatives, this one will not change the relative natural distribution of the two climate-dictated biomes on the island. However, it will also be subject to any changes in climate that may occur over the coming century and more.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

This alternative will allow natural ecosystem processes to occur largely unimpeded throughout almost all terrestrial portions of the park, and re-establish the ecological role of naturally-ignited, wildland fires in disturbing plant communities. The natural fire return interval, with all its inherent variability and unpredictability, will be permitted to determine which forest stands burn and when.

However, because of past human interventions, primarily fire suppression for decades, existing plant communities are no longer the outcome of entirely natural forces and ecological succession. Furthermore, the influence of moose browsing on stand and understory composition and structure has apparently helped fashion a forest that is less responsive to fire and therefore less capable of being shaped by it. Thus, whether or not naturally-ignited fires could occur with sufficient frequency and size to constitute a large-scale beneficial effect on the islands' plant communities is uncertain. This alternative's impacts will be long-term and regional, but whether they will be positive or negative cannot be ascertained at this time. Its intensity could therefore range from minor adverse to minor beneficial.

Alternative 4 will not change the relative occurrence of the boreal forest and northern hardwood forest biomes on Isle Royale National Park. As discussed above, the potential influence of long-term climate change is much more profound.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

In relying exclusively on prescribed fire to achieve fuel reduction and habitat management objectives, Alternative 5 would result in impacts to vegetation expected to be long-term, regional, and probably moderately beneficial. By using prescribed fire throughout the park more than Alternative 1 and 2 do, and explicitly for purposes of habitat management and achieving management targets for vegetation, this alternative would likely have the greatest beneficial effect on the vegetation communities of Isle Royale, if it could be implemented successfully. Of all the FMP alternatives, #5 is likely to realize the greatest benefit for Isle Royale's vegetation, if judged by resource management's targets, goals, and objectives.

Cumulative Impacts

Over the long term, changes in vegetation are difficult to predict due to the number of variables involved. If moose were to be substantially reduced in numbers for whatever reason, and the boreal forest could begin to recover some of its crown cover, stem density, and propensity to accumulate fuels over time, then eventually, larger, more intensive fires are probable under some of the alternatives. If moose browse pressure continues to impede tree recruitment or direct forest succession by sharply reducing the quantity of woody materials, then fuels may not ever accumulate to levels where anything more intense than periodic surface fires could occur.

Over the long term, implementing any of the FMP alternatives would have no effect on the distribution and relative occurrence of the two main biomes at Isle Royale. However, if the predictions of climatologists are accurate, it appears probable the existing occurrence pattern of these biomes on Isle Royale will shift as a result of global climate change. Temperatures are documented to be rising around the world, and even greater rises are projected over the coming century. Precipitation patterns are predicted to change as well, although there is a greater degree of uncertainty as to precisely which areas are likely to experience greater precipitation and which less. Throughout North America, the boreal forest is predicted to shift northward. At Isle Royale, located as it is at the margin or ecotone between two major ecosystems, this signifies that the northern hardwood forest is likely to dominate a greater share of the island a century from now, and the boreal forest will have retreated northward, and perhaps have disappeared from Isle Royale altogether.

Alternative 3, the complete suppression alternative, will continue to build upon the prior cumulative impacts of the better part of a century of fire suppression on community structure, age class, and composition. The other four alternatives, to one degree or another, represent a break from the results of the unnatural suppression approach to fire management.

Throughout the expanded region straddling the border between northern Minnesota, northern Michigan, and southern Ontario, as well as in the rest of North America, there tends to be beneficial cumulative impacts on the forest resource related to the more realistic assessment of the ecological role of fire and its potential as a habitat management tool that are now prevalent among resource managers. Increasing use of prescribed fire and wildland fire use in the Border Waters Fire Complex and elsewhere reflect this new understanding.

Long-term climate change from the accumulation of greenhouse gases such as carbon dioxide and methane has a much greater potential to bring about pronounced changes in vegetation at the park than any of the fire management alternatives.

Conclusion

Impacts to vegetation from all alternatives will be long-term in duration and regional in extent. Over the 10-15 year life of the FMP, Alternatives 1 and 3 will likely result in minor to moderately adverse impacts on the park's vegetation communities. If Alternatives 1 and 3 were to be continued beyond the life of the plan, these impacts could worsen to moderate or major in intensity. Alternative 2 is more likely to result in beneficial impacts to vegetation, by allowing

for more extensive use of prescribed fire as habitat management tool, if ongoing research indicates the desirability of so doing. Alternative 4's impact could range from adverse and minor in intensity to minor and beneficial, depending on the specific characteristics of naturally-ignited wildland fires and the extent to which they return. If it could be vigorously implemented, Alternative 5 would likely have moderately beneficial impacts on the park's vegetation.

In summary then, implementation of Alternatives 1, 2, 4 and 5 will not impair vegetation and related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

In contrast, Alternative 3 is especially likely to perpetuate the existing, unsatisfactory conditions and trends in the park's vegetation community types. Over the medium to long term, it will produce adverse impacts of moderate intensity, which may possibly be regarded as an impairment of the park's vegetation resources. But even this these conditions may not persist indefinitely, because one or more severe unwanted wildland fires could possibly be triggered under this alternative and lead to abrupt changes in the park's forest communities. At first, stand-replacement fires will be perceived as negative, but viewed in a larger context, they can be restorative and therapeutic for the forest.

4.2.6 Wildlife and Fisheries

Methodology for Assessing Impacts

Impacts to wildlife and fisheries from the five alternatives were qualitatively assessed by means of a literature review of the effects of fire on wildlife habitat, consultation with biologists, and professional judgment. While the alternatives differ in their effects on wildlife and fisheries, none will lead to an impairment of these resources.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

The impact of Alternative 1 on wildlife will be long-term in duration and regional in extent. However, with regard to the intensity of impact, it is difficult to predict whether this alternative's long-term overall impact on wildlife in general will be beneficial or adverse. Although in its implementation to date the 1992 FMP has largely been ineffectual in reversing the long-term degradation of wildlife habitat that was underway well before its approval in 1992, hypothetically its future performance could range somewhere between continuing minor adverse to minor beneficial, the latter if meteorological conditions were to favor more wildland fire use. On the other hand, with some exceptions (such as when accidental spills of toxic retardants into watercourses occur), impacts on fisheries will generally be negligible.

Under this alternative and each of the others, some wildlife, especially smaller or less mobile organisms, or those that are nesting on or near the ground (including young), will be subject to direct mortality from fires, both wildland and prescribed, and to a smaller extent from suppression actions themselves. Overall, this direct mortality will be relatively inconsequential in terms of its

effects on the viability of wildlife populations. Species native to this area are fire-adapted and have succeeded in coping with the effects of fire for millennia. Mechanical hazard fuel reduction will also cause a relatively negligible amount of direct mortality.

Excluding fire from Isle Royale (and elsewhere in the region) for the majority of the 20th century is generally regarded to have had pronounced, negative effects on the value of the island's habitat for wildlife. However, the effects of overbrowsing by the large moose herd may have had just as strong an impact. As is often the case with animals whose numbers are at or above the carrying capacity of their habitat, moose's dietary preferences appear to have reduced the ability of Isle Royale's vegetation to support moose themselves. Effects of fire suppression and moose food habits on the island's other dozen or so mammals and handfuls of reptiles and amphibians have not been well-studied.

In general, this alternative (and all the others) will have negligible adverse impacts on the park's fisheries, as long as proper precautions (i.e. mitigation measures) are followed in the use of fire retardants during suppression efforts. Short-term toxicity tests have showed that both fire-retardant and foam-suppressant chemicals are highly toxic to aquatic organisms, including algae, aquatic invertebrates, and fish (Hamilton, et al., no date). The primary toxin in retardants is ammonia, while in foam suppressants it is the surfactant. If fire-fighters comply with the procedures and buffer zones listed in Section 4.2.2 of this EA, adverse effects on the park's aquatic ecosystems should be avoided altogether.

Alternative 2 – Modified No Action (*Preferred Alternative*)

This alternative will have impacts on wildlife that are long-term, regional, and if it succeeds, largely beneficial for wildlife. Its adverse impacts on fisheries (from the use of fire-fighting chemicals) are likely to be negligible.

By encouraging greater use of prescribed fire (if ongoing study shows this to be desirable), as well as expanding the prescriptions for wildland fire use, so that more acreage can be burned for resource benefits rather than initiating a suppression response so much of the time, this alternative should make progress in the direction of restoring the ecological role of fire in Isle Royale's natural communities. For reasons discussed under Alternative 1, wildlife species should benefit by the habitat changes and restored ecological niches that are likely to result, such the rejuvenation of now-senescent forest stands and establishment of a variety of successional stages. In addition, as described above in the section on vegetation, fires tend to at least temporarily improve the quality of plant forage for wildlife, furnishing more nutrients and protein and less lignin and crude fiber (Hunter, 1990).

Alternative 3 – Complete Suppression of All Wildland Fires

This alternative will probably perpetuate generally negative trends in wildlife habitat value, with adverse impacts on wildlife populations throughout the park for the duration of the FMP as well as the foreseeable future. Overall, its impacts on wildlife will be long-term, regional in scope, and of minor to moderate adverse intensity.

This alternative will continue the earlier park policy of total suppression of all wildland fires, which as described above, have led to generally negative changes in habitat that are generally hostile to the park's wildlife. However, as described in other sections of this chapter, at some point in the future, accumulated fuels may catch fire during extreme weather conditions whose precise timing is impossible to predict but whose eventual appearance is all but certain. Such a fire could overwhelm suppression efforts, burning a sizeable portion of the park. These post-burn conditions could benefit moose, for example, but would not establish the kind of habitat mosaic that supported such a rich diversity of wildlife in the past.

Provided that recommended precautions are taken in the use of fire-fighting chemicals, as outlined in Section 4.2.2, impacts of Alternative 3 on fisheries and other aquatic life should be negligible.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

The impacts of this alternative on wildlife will probably be similar to those of Alternative 1 described above, and for the same reasons. During the life of the FMP, the near-exclusive reliance of Alternative 4 upon naturally-ignited wildland fires over the great bulk of the park will be unlikely to reverse the long-term, gradual decline in wildlife habitat values. Thus, this alternative will have impacts that are long-term, regional, and probably minor adverse. If, on the other hand, weather conditions bring about a substantial increase in the acreage of wildland fire use, Alternative 4 could have generally beneficial effects on wildlife habitat and abundance.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Alternative 5 would have negligible effects on the parks fisheries. With regard to wildlife, like Alternative 2, this alternative would likely yield long-term, regional moderately benefits to wildlife habitat and populations by moving toward the re-creation of a mosaic of vegetation communities and early seral stages that once existed in the park. These changes would take decades to come to fruition; the process would still be in its initial stages during the lifetime of the new FMP. Habitat and wildlife benefits are likely to occur incrementally and more predictably than in Alternatives 1, 2 and 4.

Cumulative Impacts

In the larger context, several geographically-extensive (in time and space) trends are underway with potential impacts on the parks wildlife and fisheries: the long-range transport of toxic contaminants, climate change, and declining neotropical bird populations. The first refers to toxins that can be deposited in park soils, waters and sediments, working their way up the food chain and becoming more concentrated as they do. Overall trends appear to be mixed, with some pollutants on the rise and others diminishing. Fortunately, at present the latter appear to be more dominant, in that the populations of predators at the top of the food chain like the bald eagle, osprey, and double-crested cormorant have been increasing in the park. Nevertheless, a number of concerns remain about a variety of potential chronic effects of toxins on wildlife. The second trend, climate change, if it occurs as predicted by climatologists, will undoubtedly affect wildlife abundance, diversity and distribution, indirectly by means of forcing habitat alteration.

In the future, at least through the life of this FMP, Alternatives 1 and 3 will likely result in a slow, gradual accumulation of fuels over parts of the park, maturing or decadent forest, continuing conversion toward savanna conditions in boreal forest areas, and ongoing gradual decline in habitat value at least for moose. Birds dependent on more mature forest, a closed forest canopy, or greater stem density would impacted negatively; other bird species that prefer more open or savanna-like conditions could benefit from such a habitat change. However, at some point in the coming decades, at a precise time that cannot be predicted, a major fire or fires may well occur under these alternatives, and reintroduce early successional stages across one or more portions of Isle Royale and its neighboring islands. Such a fire or fires may cause some direct mortality to wildlife, but this effect would be temporary. Aspens and birch that re-sprout in burned areas would improve moose habitat for some decades.

The combination of habitat fragmentation in North America and habitat loss in South America (affecting neo-tropical migrants) appears to have led to marked declines in the continental populations of various species.

The precise interaction, if any, between habitat changes that may be brought about by different approaches to fire management and each of the above trends is unclear at this juncture.

Conclusion

In the coming decades, Alternatives 1 and 4 will likely be unable to prevent the continued development of habitat conditions that are largely unfavorable to wildlife, while Alternative 3 is even more likely to perpetuate adverse impacts. Alternative 2, if implemented fully and successfully, could begin to bring about habitat changes that are largely beneficial to wildlife at Isle Royale.

Thus, implementation of Alternatives 1, 2, 4 and 5 will not impair wildlife and related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

In contrast, Alternative 3 will in all probability perpetuate the existing, unsatisfactory conditions and trends in wildlife habitat. Over the medium to long term, it will produce adverse impacts of minor to moderate intensity, which may be regarded as an impairment of the park's wildlife resources. But even this situation will not persist indefinitely, because one or more severe unwanted wildland fires are likely to be triggered under this alternative and lead to abrupt or even devastating changes in perhaps extensive portions of the park's wildlife habitat. Initially, stand-replacement fires over a wide area will have very negative consequences for the park's wildlife, but over time, burned areas will be re-colonized by species that favor early successional stages of vegetation communities.

With regard to fisheries resources, implementation of any of the alternatives will not significantly impact, and fisheries or related values that are (1) necessary to fulfill specific

purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's GMP or other NPS planning documents.

4.2.7 Threatened and Endangered Species

Methodology for Assessing Impacts

Impacts to threatened and endangered species and critical habitat from the alternative FMP's were qualitatively assessed by means of a literature review of the effects of fire on these species, consultation with biologists and agencies, and professional judgment. Generally speaking, the conclusions of the previous sections with regard to the effects of fire on vegetation and wildlife also hold for the more specific case of listed species of flora and fauna. While the alternatives differ in their effects on threatened and endangered species, none will lead to an impairment of these resources.

General Impacts and Mitigation

Fires will occur under each of the five alternatives, as will suppression actions, although to differing degrees. Smoke, intense heat and combustion, and associated abrupt changes to habitat each hypothetically have some potential for direct and indirect negative effects on listed species, as does fire suppression, if not carried out with due regard for threatened and endangered plants and animals. On the other hand, over the medium to long term, fire can have beneficial effects on resilient ecosystems and native organisms, including populations of listed species; a corollary is that excluding fire can have deleterious effects on the same. Since wildland fires are a naturally occurring phenomenon, most species are adapted to fire in the landscape, and indeed, some have co-evolved with fire and its effects to the extent that they are dependent on it.

In an effort to minimize adverse effects associated with each of the management alternatives below, the following mitigation measures will apply to each alternative (except in the case of those measures pertaining to prescribed fire and alternatives 3 and 4, which excluded prescribed fire):

- *All active bald eagle nests, gray wolf den locations, sensitive plant locations, or any other listed species known to be present, which fall within or in close proximity to prescribed fires or wildland fires, will receive mitigation to ensure they are not impacted. If circumstances arise where a wildland fire poses a threat to an active bald eagle nest or known active wolf den, emergency consultation will occur with the U.S. Fish and Wildlife Service to consider potential mitigation actions to reduce impacts to the affected species. Specific mitigation actions that address specific circumstances and concerns will be included in individual implementation plans. These implementation plans are Prescribed Burn Plans for prescribed burns, Wildland Fire Implementations Plans (WFIPs) for WFU fires, and Incident Action Plans for suppression actions. Specific mitigation measures will be tailored to respond to the particulars of each situation. Generally, prescribed fires will not be used when conditions would result in smoke enveloping an active eagle nest, and overall, the use of prescribed fire will*

be consistent with protective buffer zones described in the Northern States Bald Eagle Recovery Plan.

- *No prescribed fires will be conducted within one-half mile of known or traditional wolf den sites prior to July 1.*
- *Fire management staff will provide Chief, Ranger Activities and Resource Management with prescribed fire plans far enough in advance to allow survey of the area.*
- *Fire management staff will inform Chief, Ranger Activities and Resource Management of unwanted wildland fire's suppression activities as soon as possible.*
- *If a fire is judged to threaten an active eagle's nest, and mitigation measures would not be effective, that fire will be suppressed.*

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Generally, Alternative 1 will likely have long-term, regional, minor adverse impacts on listed species. Among federally-listed species, the fish-eating, shoreline-nesting bald eagle (federal threatened) will probably be largely unaffected. The timber wolf (federal threatened) could eventually decline due to continuing declines in its prey species, related to unfavorable habitat trends likely to be perpetuated under this alternative (increasing acreage of mature or decadent forests and declining acreage of vigorous, young forests with ample browse). However, any such decline is not likely to be marked within the 15-year lifetime of the FMP. The same is true with regard to the wolf's designated critical habitat on Isle Royale – a possible slow, gradual decline in quality as a result of ever more stagnant stand conditions, but one that will not have worsened substantially over the next 15 years.

As discussed in Section 3.1.8, generally speaking, wolves are not at risk of injury or death from the smoke, flames or heat of any given wildland or prescribed fire. The exception to this general rule is a period of potential vulnerability for young wolf pups that would last until approximately the end of June, when they would likely be large enough and fast enough to escape approaching flames.

Bald eagles and osprey nest in mature trees near water. Nest trees tend to be large, and therefore not particularly susceptible to all but crown fires. Still, they are potentially vulnerable to large, hot fires, although other trees that survive fires would be available for new nest construction.

As discussed above, moose (listed as a species of special concern in Michigan, and the principal prey of the endangered timber wolf) do best in vigorous, young forests with ample browse. Because of that, the 1992 Eastern Timber Wolf Recovery Plan recommended that Isle Royale "permit natural fires to run their course" (USFWS, 1992).

Wolf prey like the moose generally benefit from the habitat modification wrought by fire, particularly the regeneration and rejuvenation of species that are preferred food sources. Fires create habitat favored both by moose and beaver (another prey species). Isle Royale's large fires of 1936 and 1948 are a good example – they furnished a renewed food supply for the moose population (Peterson, 1977). In 1951 they were described as prime winter habitat. Now, however,

these same areas are the least valuable in the park for moose (and thus, for wolves) because of the mature, even decadent, aspen and birch forest there.

As mentioned in Section 3.1.8, more than 75 species of plants and animals listed by the State of Michigan as endangered, threatened, or as species of Special Concern are documented at Isle Royale. Much of the flora and fauna native to the park, including those now threatened or endangered, had to be fire-adapted to survive here in the first place (Rusterholz, 2002). For example, ground-nesting birds disturbed by fire can often re-nest later (Eliason, 2002). A number of plant species are even fire-dependent, so that to the extent fire is reintroduced into the landscape, this tends to be beneficial. To the degree fire continues to be excluded, this tends to be harmful. Other plant communities, such as sphagnum bogs, rarely burn due to their high moisture content, and therefore are probably not fire-adapted.

Thus, the fires permitted (both wildland fire use and prescribed fires) under Alternative 1 will not have serious negative consequences for native plants and animals. However, because Alternative 1 will unlikely permit enough fires in the coming years to reverse decades-old habitat trends that are generally negative for listed species, overall this alternative is predicted to have minor adverse effects on threatened and endangered species.

In Alternative 1, all eagle nests, gray wolf den locations, known sensitive plant locations, or any other listed species known to be present which falls within or in close proximity to prescribed fire units, will receive mitigation in prescribed fire plans to ensure they are not impacted.

In summary, with regard to the two federally listed species and critical habitat protected under the 1973 Endangered Species Act, Alternative 1 would likely result in the following long-term impacts:

- *Gray Wolf* – may affect, but not likely to adversely affect
- *Critical Habitat for Gray Wolf* – may affect, but not likely to adversely affect
- *Bald Eagle* – no effect

Alternative 2 – Modified No Action (*Preferred Alternative*)

Generally, this alternative will have impacts on threatened and endangered species and designated critical habitat that are long-term, regional, and largely beneficial. Actively promoting the use of prescribed fire and expanding the prescribed burn areas are likely to accelerate the restoration of Isle Royale's natural communities. For reasons discussed under Alternative 1, listed species in general should benefit if Alternative 2 leads to a greater annual average of acreage burned over time, since these organisms are either fire-dependent or fire-adapted. Others like the wolf can escape direct mortality from fire and tend to prosper if the populations of their prey species increase due to more favorable habitat conditions.

As discussed in Section 3.1.8, generally speaking, wolves are not at risk of injury or death from the smoke, flames or heat of any given wildland or prescribed fire. The exception to this general rule is a period of potential vulnerability for young wolf pups that would last until approximately the end

of June, when they would likely be large enough and fast enough to escape approaching flames. For that reason, prescribed fires would not be set near suspected wolf den sites until July.
Bald eagles and osprey nest in mature trees near water. Nest trees tend to be large, and therefore not particularly susceptible to all but crown fires. Still, they are potentially vulnerable to large, hot fires, although other trees that survive fires would be available for new nest construction.

As discussed above, moose (listed as a species of special concern in Michigan, and the principal prey of the endangered timber wolf) do best in vigorous, young forests with ample browse. Because of that, the 1992 Eastern Timber Wolf Recovery Plan recommended that Isle Royale "permit natural fires to run their course" (USFWS, 1992). Moose would probably benefit and moose populations likely increase as a result of the increased food supply this alternative would promote.

Wolf prey like the moose generally benefit from the habitat modification wrought by fire, particularly the regeneration and rejuvenation of species that are preferred food sources. Fires create habitat favored both by moose and beaver (another prey species). Isle Royale's large fires of 1936 and 1948 are a good example – they furnished a renewed food supply for the moose population (Peterson, 1977). In 1951 they were described as prime winter habitat. Now, however, these same areas are the least valuable in the park for moose (and thus, for wolves) because of the mature, even decadent, aspen and birch forest there. Alternative 2 would gradually increase the amount of moose browse in Isle Royale's forests, thus improving critical habitat for the gray wolf.

As mentioned in Section 3.1.8, more than 75 species of plants and animals listed by the State of Michigan as endangered, threatened, or as species of Special Concern are documented at Isle Royale. Much of the flora and fauna native to the park, including those now threatened or endangered, had to be fire-adapted to survive here in the first place (Rusterholz, 2002). For example, ground-nesting birds disturbed by fire can often re-nest later (Eliason, 2002). A number of plant species are even fire-dependent, so that to the extent fire is reintroduced into the landscape, this tends to be beneficial. To the degree fire continues to be excluded, this tends to be harmful. Other plant communities, such as sphagnum bogs, rarely burn due to their high moisture content, and therefore are probably not fire-adapted.

Thus, the fires permitted (both wildland fire use and prescribed fires) under Alternative 2 will not have serious adverse effects on native plants and animals. However, unlike Alternative 1, Alternative 2 would specifically aim to foster enough fires in the coming years to reverse decades-old habitat trends that are generally negative for listed species. Thus, overall Alternative 2 is predicted to have minor beneficial effects on threatened and endangered species.

In Alternative 2, all eagle nests, gray wolf den locations, known sensitive plant locations, or any other listed species known to be present which falls within or in close proximity to prescribed fire units, will receive mitigation in prescribed fire plans to ensure they are not impacted. All of the general mitigation measures listed above will be implemented in Alternative 2.

In summary, with regard to the two federally listed species and critical habitat protected under the 1973 Endangered Species Act, Alternative 2 would likely result in the following long-term impacts:

- *Gray Wolf* – may affect, but not likely to adversely affect
- *Critical Habitat for Gray Wolf* – may affect, but not likely to adversely affect
- *Bald Eagle* – no effect

Alternative 3 – Complete Suppression of All Wildland Fires

In general, Alternative 3 will likely have long-term, regional, minor to moderate adverse impacts on listed species and critical habitat. While this alternative will reduce exposure of listed species to the direct negative effects of fire, by excluding fires from the ecosystem it will only perpetuate the ongoing, long-term decline in the value of Isle Royale's vegetation communities as wildlife habitat. Excluding fire will also harm the long-term prospects of those listed plants that are fire-dependent.

In summary, with regard to the two federally listed species and critical habitat protected under the 1973 Endangered Species Act, Alternative 3 would likely result in the following long-term impacts:

- *Gray Wolf* – is likely to adversely affect
- *Critical Habitat for Gray Wolf* – is likely to adversely affect
- *Bald Eagle* – no effect

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

The impacts of this alternative on threatened and endangered species will probably be similar to those of Alternative 1 described above, and for the same reasons. During the life of the new FMP, the near-exclusive reliance of Alternative 4 upon naturally-ignited wildland fires over the great bulk of the park will be unlikely to arrest the long-term shift toward plant communities that exclude fire-dependent and fire-adapted species (some of which are listed) as well as the gradual decline in wildlife habitat values. Thus, this alternative will have impacts on listed species that are long-term, regional, and probably minor adverse. If, on the other hand, weather conditions bring about a substantial increase in the acreage of WFU, Alternative 4 could have somewhat beneficial effects on wildlife habitat and abundance in general, and listed species in particular.

In summary, with regard to the two federally listed species and critical habitat protected under the 1973 Endangered Species Act, Alternative 4 would likely result in the following long-term impacts:

- *Gray Wolf* – may affect, but not likely to adversely affect
- *Critical Habitat for Gray Wolf* – may affect, but not likely to adversely affect
- *Bald Eagle* – no effect

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

This alternative, by attempting to replicate the idealized ecological role of fires with an energetic prescribed fire program, would likely yield long-term, regional benefits to wildlife habitat and

populations in general and to threatened and endangered species and designated critical habitat in particular. In particular, to the extent it succeeded in replacing decadent forest stands with more youthful, vigorous ones containing abundant browse to support a healthy moose herd, it would increase the principal prey species of the federally endangered wolf.

In summary, with regard to the two federally listed species and critical habitat protected under the 1973 Endangered Species Act, Alternative 5 would likely result in the following long-term impacts:

- *Gray Wolf* – may affect, but not likely to adversely affect
- *Critical Habitat for Gray Wolf* – may affect, but not likely to adversely affect
- *Bald Eagle* – no effect

Cumulative Impacts

As with vegetation and wildlife in general, a number of factors have had cumulative effects, largely negative in sum, on the viability of the populations of those organisms that are now listed as threatened or endangered species. These same factors, and others, perhaps climate change for example, will bear on the survival of these species in the future. The trends for some listed species are positive and for others, uncertain, mixed, or negative. Regional and national trends for the two federal listed species, the timber wolf and the bald eagle, are generally positive. There are no reasonably foreseeable future projects or actions that, in conjunction with the proposed action, are known to threaten the continued existence of any given listed species.

For the purposes of the federal Endangered Species Act, cumulative effects refer only to reasonably certain non-federal actions, because all federal actions are covered by Section 7 consultation. Since Isle Royale National Park is entirely owned by the federal government (NPS), no reasonably certain, non-federal actions with potential cumulative effects would occur on the islands that comprise the national park and provide a home for the bald eagle and gray wolf, as well as critical habitat for the latter.

Conclusion

In the coming decades, Alternatives 1, 3 and 4 may be unable to prevent the continuation of trends in habitat conditions that are directly or indirectly unfavorable to one federal endangered species, the timber wolf. For the same reason, these three alternatives are likely to have minor adverse effects on a number of species listed by the State of Michigan. Alternative 3, if implemented, will probably result in even more adverse impacts for the wolf and state-listed species or species of Special Concern. Alternatives 2 and 5, if implemented fully and successfully, should prove generally beneficial to listed species in Isle Royale. A number of other listed species are either water-related, transient, migratory, or undocumented in the park, and therefore unlikely to be affected either positively or negatively by any of the alternatives.

Thus, implementation of Alternatives 2 and 5 will not impair threatened or endangered species or related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or

opportunities its enjoyment, and (3) identified as a goal in the park's GMP or other NPS planning documents.

In contrast, Alternatives 1, 3 and 4, to differing degrees, by perpetuating the existing, unsatisfactory conditions and trends in the park's wildlife habitat, would probably result in mid-term to long-term adverse impacts ranging from minor to moderate intensity on the park's listed organisms, which might possibly be regarded as an impairment of the park's sensitive species. These alternatives are likely to set the stage for large, severe fires in the coming decades that could have both adverse and beneficial effects on threatened and endangered species.

4.2.8 Wilderness

Methodology for Assessing Impacts

Impacts to wilderness were evaluated qualitatively by examining the letter and spirit of the 1964 Wilderness Act and NPS policies, consulting with wilderness authorities, making comparisons with fire management in nearby wilderness areas, such as the Boundary Waters Canoe Area Wilderness (BWCAW) of the Superior National Forest, and professional judgment and experience. None of the alternatives will impair areas designated by Congress as Wilderness under the 1964 Wilderness Act.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

This alternative will have negligible to minor adverse effects on designated Wilderness within the park. Under Alternative 1, these areas will retain their "primeval character," will receive no permanent improvements or human habitation, and will still appear "to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable" (Section 2(c), Wilderness Act).

Fire is a natural force, and thus neither wildland fire use nor occasional prescribed fire are deemed by federal land managers as being inherently incompatible with wilderness character and values; indeed, they are encouraged. However, as mentioned in Section 3.1.9, in order to conduct prescribed fires within the designated Wilderness areas, the park's Wilderness Management Plan (WMP) must address the prescriptions and procedures under which the program will be conducted within the wilderness. Isle Royale does not yet have an approved WMP, on which development began in 1999. Its completion is anticipated in the coming year. With regard to fire, it is expected that the WMP will state that MIST practices must be used in suppression and that park staff will follow the Minimum Requirement Process when doing any prescribed burning. The WMP itself will also state that prescribed burning is permissible as long as it meets overall park and natural resource objectives. In any event, with Isle Royale's Alternative 1, the Wildland Fire Use FMU encompasses most of the designated Wilderness, so that natural fire ignition is emphasized.

Under this and every other alternative, suppression actions to control unwanted wildland fires may take place in the designated Wilderness. The park must weigh values at risk, including human life, nearby improvements, wilderness values, habitat and wildlife values. Per Director's Order #41 on Wilderness Preservation and Management (NPS, 1999), each alternative will require the use of hand

power tools and MIST within areas of designated Wilderness so as to minimize the effect of temporary human disturbances and intrusions.

Noise and general disturbance associated with both prescribed fire and fire suppression activity will probably last no more than a few days or weeks per decade, more or less. This should be placed in the context of Isle Royale's existing ambient noise conditions. Aircraft and powerboats already subject the park's designated Wilderness to substantial levels of artificial noise on a daily basis throughout the visitor season, certainly enough to impede on the sense of solitude that Wilderness is supposed to impart. Existing conditions and use patterns regularly expose Isle Royale's Wilderness to a good deal more noise and disturbance than infrequent fire management activities will.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Alternative 2 aims to more actively engage fire as a beneficial tool for habitat management throughout more of the park. These efforts, including wildland fire use, more prescribed fires, and some fire suppression, should not seriously compromise wilderness values. Overall, as with Alternative 1, Alternative 2's adverse impacts on designated Wilderness will likely be negligible.

As mentioned under #1 above however, Isle Royale will not be able to conduct prescribed fires within designated Wilderness until it has an approved Wilderness Management Plan, the preparation of which is ongoing.

Alternative 3 – Complete Suppression of All Wildland Fires

Alternative 3 will have minor adverse effects on designated Wilderness within the park. This alternative will retain certain wilderness values – such as the appearance of wildness at most times and the absence of improvements and human inhabitants. Yet by actively excluding a critical natural force that shapes habitats and the landscape, Alternative 3 may be violating the spirit if not the letter of the Wilderness Act. In addition, the greater level of suppression activity that will occur under this alternative runs the risk of minor interference both with the solitude and appearance of wilderness. If extreme weather conditions eventually trigger a large wildland fire in the park, the impact of both the fire on the landscape and intensive suppression activities on the integrity of the wilderness could be substantial.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

Under this alternative, the Wildland Fire Use FMU will include virtually all designated Wilderness within the park. In this FMU, natural ignition of wildland fires is emphasized, in keeping with the idea that in wilderness area natural forces should predominate. Moreover, no prescribed fires and more limited fire suppression will take place in this FMU. Thus, this alternative not only preserves the appearance of wildness but will also allow freer rein for the forces of nature to operate unimpeded. Alternative 4's impacts on wilderness will likely be negligible at most.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Under this alternative, prescribed fire would be used in place of wildland fire use throughout the park. Alternative 5 would retain many wilderness values, such as the absence of improvements and human inhabitants, and the presence of high-quality habitat, wildlife, and landscapes in which "the imprint of man's work [is] substantially unnoticeable."

The philosophical conflict between this alternative and the "spirit" of wilderness is that #5 entirely replaces naturally-ignited wildland fires as a force in landscape and habitat modification with deliberately-set, human-managed prescribed fires. Thus, it does not allow natural forces to operate freely. Nevertheless, by proactively using and manipulating this force of nature, the "appearance" of the landscape of having "been affected primarily by the forces of nature" (as called for in Section 2(c) of the Wilderness Act) can be maintained. This is an unresolved, ongoing debate over the philosophy, spirit, and intent of the Wilderness Act. In the more practical vein, most visitors to wilderness areas at Isle Royale would not notice or particularly care about this direct management intervention in natural processes. Thus, Alternative 5's impact on wilderness would be negligible or minor at most.

Cumulative Impacts

Wilderness in the park is already subjected to a host of unnatural influences, including noise from aircraft and motorboats, air pollution and deposition of contaminants, reduced wildlife populations and modified vegetation communities, among others. In the future, large-scale disturbances related to human activity like climate change may call into question how "wild" any area is anymore. Still, to most visitors and wilderness enthusiasts, Isle Royale's wilderness retains much of its wilderness character. None of the FMP alternatives will cause an impairment of these attributes.

Conclusion

All of the FMP alternatives will largely respect wilderness values in the park, with adverse effects being limited to negligible or minor intensity. By allowing for greater wildland fire use over most of the park, Alterative 4 will arguably comply most thoroughly with the intent of the Wilderness Act, although Alternatives 2 and 5 offer the greatest hope for restoring habitat values consistent with enhancing and preserving the native flora and fauna associated with wilderness.

In summary, the implementation of any of the alternatives will not impair wilderness or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's GMP or other NPS planning documents.

4.2.9 Noise

Methodology for Assessing Impacts

Impacts from noise associated with fire management activities at Isle Royale National Park were evaluated qualitatively by examining probable patterns (location, duration, timing and frequency) of noise-generating activities in the context of NPS management policies and the existing acoustical environment at Isle Royale. Noise levels were also quantitatively determined using the Highway Construction Noise Measurement, Prediction, and Mitigation methodology (Federal Highway Administration). Noise impacts were then assessed with respect to the location of sensitive receptors. None of the alternatives would significantly impact the soundscape of the park.

General Impacts

Fire suppression, prescribed burning, and mechanical fuel treatment all involve the use of motorized equipment that generates noise. In a national park setting, noise has the potential to impact both humans and wildlife. For humans, noise can affect recreational experiences and the enjoyment of wilderness values. For wildlife, noise may disrupt activities such as feeding, breeding, and nesting. This is of particular concern for threatened and endangered species.

Noise disturbance is one of the primary impacts of both fixed-wing aircraft and helicopters used in fire suppression. With the use of helicopters, the potential for noise impacts increases, as flight frequency normally increases dramatically and missions expand to include landings.

In general, laboratory studies and limited field research to date have discovered four principal ways in which wildlife may be adversely affected by noise pollution:

- hearing loss, resulting from noise levels of 85 db or greater;
- masking, or the inability to hear important environmental cues and animal signals;
- non-auditory physiological effects, like increased heart rate and respiration and general stress reaction; and
- behavioral effects, which vary widely between species and noise characteristics, resulting in, for instance, abandonment of territory and lost reproduction (Cornman, 2001).

Three of the principal noise-generating, motorized devices that would be used in each of the FMP alternatives are chainsaws, helicopters and propeller aircraft. Chainsaws can reach 110 dB (Health & Safety Executive, 2000), helicopters 105 dB and propeller aircraft 120 dB (Roeser, no date). While each of these devices exceeds the 85 dB threshold cited above, sound and noise are attenuated (reduced in intensity) with distance; both forest cover and uneven terrain accentuate the rate of sound attenuation (NYDEC, 2001). Thus, at Isle Royale, adverse effects on wildlife from the use of this fire-related equipment are likely to be localized and temporary, and minor, although much more field research in the area of noise impacts on wildlife would be necessary to render a more definitive assessment. Noise *per se* is only part of the overall disturbance to which wildlife is subjected with the introduction of motors, human traffic, and fire itself into their habitat or nesting sites.

Noise calculations were performed for mechanical and thinning activities using the Federal Highway Administration's Construction Noise Measurement, Prediction, and Mitigation methodology. Noise level calculations were performed assuming that obstructions that may impede the propagation of sound (buildings, vegetation, etc.) were not present, and that the land between the source of the sound and the receiver was flat. Thus the noise level calculations should be considered a "worst-case" measure. Based on the noise modeling calculations, ambient sound levels of about 45 dBA characteristic of wilderness or backcountry would be reached at a distance of approximately 5,000 feet (i.e. about one mile or 1.5 km) from the source of manual and mechanical thinning activities. Sound levels would be reduced even further if noise-generating activities occurred within dense vegetation, especially conifer forests. Dense vegetation that is at least 100 ft. deep would reduce the sound levels by 3 to 7 dBA (NYDEC, 2000). Thus, ambient noise levels of 45 dBA could be reached within 2,500 ft. (about one-half mile or 0.8 km) of project operations with the previous assumptions.

Since wildland and/or prescribed fires can occur virtually anywhere in the entire terrestrial surface area of the park, chainsaws, airplanes and helicopters could potentially be used anywhere in the park under each of the alternatives below. However, motorized vehicles and motorboats will not be used in the Wilderness. Furthermore, at any given place within the park, the use of mechanized, noise-generating equipment will be very infrequent, on the order of hours, days, or at most weeks per decade. This is not frequent enough to substantially interfere with recreational human activities in the area or with wildlife behavior. Nor will such infrequent bursts of noise chronically impair the solitude and tranquility associated with wilderness.

Two other relevant factors in considering the impacts from FMP-associated noise are: 1) the general paucity of "noise-sensitive receptors" (e.g. schools, hospitals, nursing homes, churches) within and adjacent to the national park; and 2) the widespread, persistent background noise from the engines of motorboats and aircraft that already pervades much of the park. Isle Royale does not possess a pristine acoustic environment, in spite of the generally wild landscape and wildlife this national park protects. Relative to existing ambient noise levels, impacts from the FMP alternatives below are rather inconsequential.

Nevertheless, steps can be taken to mitigate the impact of noise associated with fire suppression and fuels treatment at Isle Royale. To reduce noise impacts from overflights or other equipment on sensitive species such as the currently-threatened bald eagle, the Area Fire Management Officer will work with park Natural Resources staff to determine unit-specific mitigation measures in the operational plans for the fire activity. Operational plans include the Wildland Fire Implementation Plan for wildland fire use fires, prescribed fire plans, or incident action plans for suppression activities. Active bald eagle nests will be avoided entirely if possible. If it is determined that using aircraft in the vicinity of nesting bald eagles is necessary, takeoffs and landings will be avoided within 1/4 mile (0.4 km) of the nest. Under no circumstances shall aircraft be within 500 feet (150 m) of a nest. Recurring activity (passes, circling, hovering) will remain 1,500 feet (450 m) or more above ground level. Noise impacts will be evaluated as park managers determine the "Appropriate Management Response" for a fire.

Fuel treatments near the campgrounds and developed areas would be restricted to times of low visitor use of the park to minimize and/or eliminate noise impacts on recreationists and visitors.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

In any given area, noise from fire suppression activity under Alternative 1 would probably last no more than a few days or weeks per decade, more or less. This should be placed in the context of Isle Royale's existing ambient noise conditions, addressed in Section 3.1.10, which emphasize that much of the park is regularly exposed to intermittent noise from powerboats and aircraft on a daily basis from April to October. Thus, noise impacts from the No Action Alternative would be temporary, localized and negligible to minor.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Alternative 2 aims to more actively engage fire as a beneficial tool for habitat management throughout more of the park. These efforts, including wildland fire use, more prescribed fires, and some fire suppression, should not seriously compromise Isle Royale's acoustical environment and wilderness character. As with Alternative 1, in any given area, noise from the various fire management activities associated with Alternative 2 would probably last no more than a few days or weeks per decade. Again, this is a minimal change to the existing noise environment in the park. Thus, noise impacts from the Preferred Alternative would also be temporary, localized and negligible to minor, like those of the No Action Alternative.

Alternative 3 – Complete Suppression of All Wildland Fires

In most years, the suppression activities under Alternative 3 would lead to temporary, localized and negligible to minor noise impacts. When extreme weather conditions and fuel accumulation eventually trigger a large wildland fire in the park perhaps several times per century, a much greater suppression effort would be undertaken with correspondingly greater noise levels from helicopters and fixed-wing aircraft. Still, over the long term, noise impacts from this alternative would be temporary, localized, and negligible to minor.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

This alternative, emphasizing wildland fire use over most of the park, would have noise impacts similar to the previous three alternatives – temporary, localized, and negligible to minor. It would avoid the relatively small amounts of year-to-year noise from the suppression activities of Alternatives 1 and 3 and the prescribed fire activities of Alternative 2. Under this alternative, developed areas in the park would likely be exposed for several days every few years to the sound of chainsaws and/or other power hand tools being used for hazard fuel reduction in their vicinity.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Under this alternative, prescribed fire would be used in place of wildland fire use throughout the park. Like the previous four alternatives, the noise impacts of Alternative 5 are likely to be

temporary, localized, and negligible to minor in intensity. With a greater rate of prescribed burning, noise would generally be more spread out over time, and would emanate more from chainsaws, vehicles and other equipment than helicopters or fixed-wing aircraft.

Cumulative Impacts

Although there is not a constant level of ambient, artificial noise, passing motorboats and aircraft generate intermittent, motorized sound that pervades much of the park on a daily basis during the visitor season (April to October). Against this background, the potentially loud but localized and highly infrequent incidents of noise from fire management activities, including suppression of unwanted wildland fires, prescribed burning and mechanical thinning, would not add significantly to the cumulative noise burden of Isle Royale.

Conclusion

Implementation of any of the alternatives would not significantly impact, and thus impair, the soundscape of Isle Royale National Park and related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.3 CULTURAL RESOURCES

Methodology for Assessing Impacts

Impacts to cultural resources were assessed qualitatively by examining literature on the impact of fires and fire suppression on cultural resources and by discussions with archeologists and cultural resource authorities. None of the alternatives will lead to an impairment of the park's cultural resources.

Management and protection of cultural resources within the Federal Wildland Fire Management Program is a complex process (Gleeson and Jones, 2000). At present, federal land managers, including the NPS, USFS, BIA, BLM and USFWS, are working jointly to develop a comprehensive management strategy and Programmatic Agreement (PA) that is consistent with Section 106 of the Historic Preservation Act. The goal is to protect historic sites, structures, landscapes and traditional cultural sites while meeting fire management objectives.

General Impacts and Mitigation

The effects of fire on cultural resources are still not well understood or documented. To date, much of the literature on the subject is anecdotal and qualitative (Gleeson and Jones, 2000), rather than based on controlled scientific studies. For example, post-fire observations are often unable to distinguish between damage to archeological resources caused by the fire itself from damage that was pre-existing. Thus, the following discussion of potential impacts of fire and fire management on cultural resources is of necessity general and somewhat speculative.

Both wildland fires and wildland fire suppression can affect cultural resources and historic properties. Fires themselves can and often do destroy historic structures or properties, especially those constructed of wood or other flammable material. Historic districts and cultural landscapes are also somewhat vulnerable to adverse impacts or destruction from unwanted wildland fires. On the other hand, by burning up ground vegetation and forest litter, fires can clear an area, potentially making archeological surveys easier and more productive.

The vulnerability of subsurface archeological resources and artifacts to fire depends not only on the nature of the materials themselves but on the intensity of the fire, depth below surface, soil moisture, amount of duff layer, and other factors. Hotter surface fires penetrate more deeply into the subsurface and can potentially cause more damage. Glass bottles can be cracked or broken for example. On the other hand, ceramics or objects carved or chipped from stone are likely to be more resistant to fire and heat. Since fires regularly swept across the Isle Royale landscape for centuries prior to the era of fire exclusion in the 20th century, for a subsurface historic object or archeological artifact to have survived into the 21st century, it must have already withstood at least several and sometimes many previous fires.

Constructing firelines associated with fire suppression can damage subsurface cultural and archeological resources by exposing, crushing, or removing them.

Isle Royale's archeological and historical resources are limited and nonrenewable; many are fragile as well. When disturbed or removed from their context, the scientific information they could furnish is often lost forever. Precautions will be taken during fire suppression and prescribed fire activities in the park not to destroy or disturb important archeological and historical resources. A complete ground survey and inventory with detailed maps of sites, features, and environmental data are the best sources of cultural resources information for fire management planning. While archeological and historical site surveys in the park are ongoing, they are still a long way from being completed. Currently, only trails, campgrounds, and some shoreline areas have been surveyed for archeological resources. Much of the interior of the park has not been surveyed.

Fire management activities that disturb the ground in any way, such as fireline construction using hand tools, will use paraprofessional and professional archeologists working in cooperation with firefighters and pre-burn preparation crews to prevent needless resource destruction. During an unwanted wildland fire the highest priorities are safety and controlling the blaze; therefore, if the fireline cannot be diverted, cultural resources may have to be sacrificed. In most cases, however, damage can be averted. For all five of the FMP alternatives below, during fire suppression, prescribed fire, and rehabilitation activities, the following measures will be undertaken to help mitigate the impacts of fire suppression and rehabilitation on cultural resources:

- *Once they are developed, resource base maps showing archeological, ethnographic, and historical site locations will be given to archeologists and fire bosses on the firelines.*
- *When known archeological sites are threatened by a fire, archeologists will be present to help mitigate the impacts of fire suppression and rehabilitation on the archeological resources. When known ethnographic sites are threatened, a*

qualified ethnographer will be consulted or brought on site to help mitigate the impacts on ethnographic resources.

- *Archeologists serving on a fire as technical specialists will need to hold a current red card to perform their specific advisory duties, but will not need to complete or pass the arduous physical exam.*
- *Line archeologists will be equipped with appropriate standard firefighting safety equipment.*
- *Special flagging will be used to identify archeological, ethnographic, and historical sites.*
- *A photographic record will be kept of all archeological materials uncovered during fire management and rehabilitation activities. In addition, accurate maps will be prepared, plus comprehensive site data including soil type and depth at which artifacts were found.*
- *The Branch Chief, Cultural Resources will coordinate all activities of line archeologists with fire bosses.*
- *An archeologist will be on site any time fireline construction or any ground breaking activities are taking place in a known archeological site.*
- *At a minimum, a paraprofessional archeologist will be present for fireline construction or any ground breaking activities in an unsurveyed location.*

In addition, fire management staff will keep Isle Royale's Branch Chief, Cultural Resources informed as to upcoming prescribed fire and suppression activities. The Branch Chief, in turn, will inform and consult with the Michigan SHPO, and if necessary, the Advisory Council on Historic Preservation (ACHP), on forthcoming projects and activities, such as prescribed fires for hazard fuel reduction in the vicinity of historic properties, to ensure compliance with Section 106 of the NHPA.

In the park's 1992 FMP, several FMAs in the Conditional Unit were established specifically to protect cultural resources; in each of the five alternatives below, except Alternative 1 (No Action), these Conditional zones have been eliminated. Nevertheless, it must be emphasized that mitigation measures will be taken to ensure the cultural resources are protected. **Every single time a fire starts, from whatever source, a key component of the WFIP analysis will be the consultation of the appropriate cultural resource maps to guide the decision on how to manage that fire.**

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

In general, Alternative 1 will result in long-term, regional impacts to cultural resources that are negligible to minor in intensity.

This alternative will protect historic structures and cultural landscapes by placing fire suppression and hazard fuel reduction zones around them. As discussed above, archeological resources, especially undiscovered and unsurveyed ones, could be affected by fire, suppression, or rehabilitation; these impacts will be mitigated by the measures described above. As stated above, in this alternative and all others, it will be necessary for fire management staff to keep the park's Branch Chief, Cultural Resources informed in advance of upcoming activities, so as to learn of any

known cultural resources on or near the site of those activities, as well as any special concerns that are pertinent to the action at hand.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Alternative 2 will also result in long-term, regional impacts to cultural resources that are negligible to minor in intensity. In many respects, the impacts of this alternative are similar or identical to those of Alternative 1. The same mitigation measures will apply. In that it aims to preserve fire-adapted or fire-dependent flora and fauna indigenous to Isle Royale, this alternative should preserve more ethnographic resources and plants and animal resources with cultural significance than the other four alternatives.

Alternative 3 – Complete Suppression of All Wildland Fires

In general, over the near to medium term of the next decade or two, Alternative 3 will result in regional impacts to cultural resources that are negligible to minor in intensity.

The impacts of this alternative are similar in many respects to those of Alternative 1, at least in the near to medium term (the next 10-15 years or so). Beyond that, if this alternative allows for excessive fuel accumulation, it may put much of the park at risk to highly destructive unwanted wildland fires, which could raise the risk some of the park's cultural resources both from intense fire and aggressive suppression efforts.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

In general, Alternative 4 will result in long-term, regional impacts to cultural resources that are negligible to minor in intensity. In many respects, the impacts of this alternative are similar or identical to those of Alternative 1. The same mitigation measures will apply.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Alternative 5 would also result in long-term, regional impacts to cultural resources that are negligible to minor in intensity. In many respects, the impacts of this alternative are similar or identical to those of Alternatives 1 and 2. The same mitigation measures would apply.

Cumulative Impacts

As stated at the outset of this section, cultural resources are limited and non-renewable and many are fragile. Over time, natural and human agents ranging from rust to erosion, microbial action, weathering, rainfall, oxidation, and vandalism all take their toll on the continued existence and integrity of archeological, historical, and cultural resources. Fire management can be conducted in such a manner as to protect known cultural resources like historic structures / properties and cultural landscapes and to minimize adverse effects on other resources such as undiscovered subsurface archeological artifacts.

Conclusion

By implementing the same mitigation measures, each of the five FMP alternatives will provide a degree of protection for historic and archeological resources, both known and undiscovered, that will likely be able to keep impacts from fire management activities to a minimum.

In summary, the implementation of any of the alternatives will not impair cultural resources or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.4 SOCIAL AND ECONOMIC ENVIRONMENT

Methodology for Assessing Impacts

As discussed in Chapter 1, the only aspect of the social and economic environment that warrants full consideration in the EA is the human health and safety situation. Impacts to human health and safety from the five FMP alternatives were assessed qualitatively by examining human health and safety precautions of the FMP and then predicting the likely effects of wildland fires, prescribed fire, and fire suppression on these factors, based on what is known about wildland fire use, fire management and fire suppression.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Federal wildland fire policy requires that all fire management activities consider safety of personnel and the public as the highest priority. Overall, the wildland fire use, prescribed fires, and unwanted wildland fire suppression activity of Alternative 1 will confer major health and safety benefits to park visitors and staff.

Assuring visitor safety will take priority over fire suppression and monitoring activities. The Fire Management Coordinator will inform other divisions of all potentially hazardous fires in the park. The Chief, Visitor Services and Resource Protection and Interpretive Specialist will then coordinate public notification efforts within and outside the park. The extent of public notice will depend on the specific fire situation.

The mitigation measures listed under Section 2.8 will be implemented with Alternative 1 and each of the other alternatives.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Impacts of this alternative are very similar to those of Alternative 1. Overall, Alternative 2 will confer major health and safety benefits to park visitors and staff.

Alternative 3 – Complete Suppression of All Wildland Fires

During most years, Alternative 3's impacts on the human health and safety in the park will be similar to those of Alternative 1 and 2 – largely beneficial. However, over the long term, and perhaps well beyond the lifetime of this FMP, the rare but destructive fires that the complete suppression alternative may help foster will have moderate to major adverse effects on human health and safety.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

During most years, Alternative 3's impacts on the human health and safety in the park will be similar to those of Alternative 1 and 2 – largely beneficial. However, by excluding prescribed fire everywhere in the park, including for the purpose of hazard fuel reduction in the suppression FMU, this alternative runs a somewhat higher risk of more substantial wildland fires in one or more suppression FMU's that could threaten the safety of park staff and visitors. Also, the larger fires that may burn on occasion under this alternative (since smaller fuel-consuming prescribed fires are precluded) could pose a greater temporary threat to visitor health and safety from smoke inhalation. Thus, overall, this alternative's potential impact on human health and safety may be minor to moderate adverse.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Impacts of this alternative are very similar to those of Alternatives 1 and 2: temporary, both localized and regional, negligible to minor adverse. By avoiding wildland fire use and probably having smaller unwanted wildland fires and fewer of them (because of continual prescribed fires that reduce fuel loads), this alternative distributes adverse impacts more evenly over time. It also confers moderate benefits to human health and safety over time by avoiding the accumulation of hazardous fuel conditions.

Cumulative Impacts

There are no other past, present, or future activities, trends, projects, or actions in or around the park that will combine with any of the FMP alternatives to produce cumulative impacts to human health and safety.

Conclusion

Implementation of any of the alternatives will generally safeguard human health and safety. Under each alternative, protecting firefighter and public health and safety is the top priority.

4.5 PARK FACILITIES & OPERATIONS, VISITOR USE & EXPERIENCE

Methodology for Assessing Impacts

Impacts to the park facilities and operations, visitor use and experience were assessed qualitatively by using professional judgment and experience, as well as discussions with park officials, to predict the likely effects of wildland fires and fire suppression on facilities, operations and visitors, based on known features and characteristics of wildland fire use, fire management and fire suppression.

Alternative 1 – No Action (Implement 1992 Wildland Fire Management Plan)

Overall, Alternative 1 will have short-term, localized and negligible adverse impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience will likely be long-term, regional in extent and minor in magnitude.

Under Alternative 1, major park facilities will be protected by suppression FMU's in which hazard fuel reduction will be practiced and active suppression undertaken during unwanted wildland fires. A regular program of prescribed fire in these suppression units will help minimize the overall risk to park facilities.

Three principal kinds of impacts will occur with regard to visitor use and experience: smoke, the appearance of burned areas, and closures. The first is invariably negative, but can be minimized by conducting prescribed fires during off-peak visitation periods. It can also be mitigated by measures discussed in the air quality section (primarily, trying to burn when wind will blow the smoke away from areas with large numbers of visitors) and the FMP's program of public information and education below.

With regard to the second impact on visitor experience – the sight of burned areas – to the visitor uninformed about the "new" understanding of fire's essential role in the natural ecology of the Isle Royale's landscape, a recently burned forest, even one touched lightly primarily on the ground by prescribed fire or wildland fire use for resource benefits, appears to have been damaged or destroyed. This adverse impact on visitor experience can be substantially mitigated by education on and off the park.

Area closures will occur to a limited extent under this alternative, inconveniencing some visitors and preventing recreation in some sites temporarily. Generally, this impact will be temporary, localized and minor to moderately adverse. Visitor reaction can be improved by education and information about the park's fire management program.

Disseminating information about fire's natural role and effects is an important step in establishing public support for such programs. Isle Royale's wildland fire management information program – which will be used in Alternative 1 as well as the other alternatives (except Alternative 3, which

will have a modified version) – will be factual, straightforward, and aimed at many different audiences. The guidelines and procedures listed in Section 2.8 will be followed.

Alternative 2 – Modified No Action (*Preferred Alternative*)

Similar to Alternative 1, Alternative 2 will have short-term, localized and negligible impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience will likely be long-term, regional in extent and minor to moderate in magnitude.

Alternative 3 – Complete Suppression of All Wildland Fires

Overall, in most years, Alternative 3 will have short-term, localized and negligible impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. In most years, its impacts on visitor use and experience will likely be temporary, localized in extent and minor in magnitude. However, under this alternative, if fuels eventually accumulate, then large, catastrophic, unwanted wildland fires will probably occur perhaps one or two times a century on average (i.e. probably not within the lifetime of this FMP) – and this occurrence will have been largely facilitated by this alternative's approach to fire. At these times, impacts on facilities will be moderate, on operations major, and on visitor use and experience also major.

Since no prescribed fires will be conducted, in most years Alternative 3 will produce fewer impacts on visitors from smoke, closures, and the sight of recently burned units than in Alternatives 1 or 2.

The public education program will be a modified version of that presented under Alternative 1, but without an emphasis on the natural role of fire.

Alternative 4 – Emphasize Wildland Fire Use and Exclude Prescribed Fire

Similar to Alternative 1, Alternative 4 will have short-term, localized and negligible impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience will likely be long-term, regional in extent and minor to moderate in magnitude.

Alternative 5 – Emphasize Prescribed Fire and Exclude Wildland Fire Use

Generally similar to Alternatives 1 and 2, Alternative 5 would have short-term, localized and negligible impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience would likely be long-term, regional in extent and minor to moderate in magnitude.

Cumulative Impacts

There are no other reasonably foreseeable actions that will combine with the FMP to produce cumulative impacts on facilities, operations, or visitor use and experience.

Conclusion

Implementation of any of the alternatives will not significantly impact, and thus impair, visitor use and experience, or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Isle Royale National Park, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning document.

Chapter 5
COORDINATION AND CONSULTATION

This chapter summarizes public scoping and other coordination and consultation conducted in conjunction with this EA on revisions to the Fire Management Plan for Isle Royale National Park Fire. It also provides a list of preparers.

5.1 PUBLIC SCOPING

Isle Royale Natural Resource Management staff initiated scoping for the EA on updating the park's Wildland FMP on December 18, 2001, with a news release (see Appendix D). The letter was mailed to approximately 110 addressees, including elected officials, the Michigan SHPO, NGO's, and the news media. The news release requested comments on issues that need to be addressed in the new FMP and suggestions on various possible ways to manage the park's fire management program. Among the NGO's that received the news release were the American Automobile Association (AAA) in Dearborn, Michigan; National Park Concessions, Inc.; World Wide Ferry Services; The Wilderness Society in Washington, D.C.; Michigan Natural Areas Council; and Sierra Club in Madison, Wisconsin.

Persons and parties interested in commenting in writing were requested to have their letters postmarked no later than January 18, 2002. Houghton, Michigan's public radio station announced that scoping was underway on the revisions to the FMP. No input was received during the month-long scoping period.

Each of the 110 recipients of the December 18, 2001 news release will again be notified at the time the Draft FMP and Draft EA are released to the public. They will be offered the opportunity to request a coy of one or both documents. In addition, relevant Federal and state agencies will have an opportunity to review and comment on both the Draft FMP and the Draft Environmental Assessment. Coordination and consultation by park natural and cultural resources management staff with various federal and state agencies is ongoing.

5.2 CONSULTATION

The study team contacted and consulted various persons and agencies with expertise in the subject matter or jurisdiction over given resources. Many of these individuals were consulted during a vegetation management workshop at Voyageurs National Park at International Falls, Minnesota in September 2001. These experts are knowledgeable about different aspects of fire management in the Border Waters Fire Complex, of which Isle Royale National Park is a part. This list is presented in Table 5.2.

Isle Royale staff contacted the Michigan SHPO, which had no comment on the Draft FMP and Preliminary Draft EA. Affiliated tribes were also sent a letter asking for input and if they would

like to receive a copy of the Draft EA. In addition, cultural resources staff contacted regional experts in ethnography and cultural anthropology.

Table 5-2. Persons and Agencies Contacted

Person Contacted	Agency/Organization
Gordon Anderson, Planner	Minnesota Pollution Control Agency, Policy and Planning Division
Roger Andrascik, Chief of Natural Resources	U.S. Department of the Interior, National Park Service, Voyageurs National Park
Craig Czarnecki, Field Supervisor	U.S. Department of the Interior, Fish and Wildlife Service, East Lansing Field Office
Mike DeCapita, Wildlife Biologist	U.S. Department of the Interior, Fish and Wildlife Service, East Lansing Field Office
Jim DeCoster, Fire Ecologist	U.S. Department of the Interior, National Park Service, Midwest Regional Office
Bonita Eliason, Supervisor	Minnesota Department of Natural Resources, Natural Heritage and Nongame Research Program
KellyAnn Gorman, Fire Ecologist	U.S. Department of the Interior, National Park Service, Great Lakes Ecoregion
Brian Grinnell	Michigan State Historic Preservation Office
Cal Gale, Fire and Natural Resource Consultant	Sub-consultant to Mangi Environmental Group, Baldwin, Wisconsin
Lee Grim, Resource Biologist	U.S. Department of the Interior, National Park Service, Voyageurs National Park
Bruce Hawkinson, Planner/Facilitator	Minnesota Department of Natural Resources, Ecological Services Division
Kevin Hop, Project Team Leader	U.S. Department of the Interior, Geological Survey, Upper Midwest Environmental Science Center
Becky Marty, Resource Manager	Minnesota Department of Natural Resources, Itasca State Park
Marla McEnaney, Cultural Resource Specialist	U.S. Department of the Interior, National Park Service, Midwest Regional Office
Doug McRae, Forest Fire Research Specialist	Canadian Forest Service, Sault Ste. Marie, Ontario
Shannon Menard, Senior Regional Ecologist	Association for Biodiversity Information
Brian Mitchell, Environmental Protection Specialist	U.S. Department of the Interior, National Park Service, Natural Resource Program Center
Jack Oelfke, Branch Chief, Natural Resources	U.S. Department of the Interior, National Park Service, Isle Royale National Park
Mark Romanski, Wildlife Biologist	U.S. Department of the Interior, National Park Service, Isle Royale National Park
Kurt Rusterholz, Forest Ecologist	Minnesota Department of Natural Resources, Natural Heritage and Nongame Research Program
Jim Schaberl, Biologist-Resource Management Specialist	U.S. Department of the Interior, National Park Service, Voyageurs National Park
John Schomaker, Natural Resources Planner	U.S. Department of the Interior, Fish and Wildlife Service, Region 3, Ft. Snelling, Minnesota
John Snyder, Cartographic Specialist	U.S. Department of the Interior, National Park Service, Voyageurs National Park

Dave Soleim, Border Waters Complex Fire Management Officer	U.S. Department of the Interior, National Park Service, Voyageurs National Park
David Szymanski, Education Specialist	U.S. Department of the Interior, National Park Service, Voyageurs National Park
Paul Tiné, Fire Management Plan Consultant / Fire Specialist	USDA Forest Service, Superior National Forest, Boundary Waters Canoe Area Wilderness (ret.)
Liz Valencia, Cultural Resource Specialist	U.S. Department of the Interior, National Park Service, Isle Royale National Park
Pat Valencia, Forestry Technician	U.S. Department of the Interior, National Park Service, Isle Royale National Park
Ronald Wilson, State Forest Fire Supervisor	Michigan DNR, Forest Management Division

5.3 LIST OF PREPARERS

The following people contributed to the preparation of this Environmental Assessment:

Name	Degree	Experience	Responsibilities
The Mangi Environmental Group, Inc.			
Jim Mangi	Ph.D. Biology	30 years	Company principal; project oversight
Leon Kolankiewicz	M.S. Environmental Planning and Resource Management; B.S. Forestry and Wildlife Management	22 years	Project manager and principal author
Webb Smith	M.A. 1994 Marine Affairs and Policy B.S. 1992 Biology	8 years	Expertise and consultation in all areas
Timothy Smith	M.A. Anthropology	28 years	Advice on Cultural Resources analysis
Rebecca Whitney	B.S. Geology and Biology	1 year	Geographic Information Specialist
Timothy Gaul	M.S. Biology; B.S. Environmental and Forest Biology	1 year	Geographic Information Specialist
Debra Wenner	M.S. Geography B.A. Geography	1 year	Geographic Information Specialist

REFERENCES CITED

(Adams and Simmons, 1999) Adams, R. and D. Simmons. 1999. Paper presented to Australian Bushfire Conference; Albury. July. http://life.csu.edu.au/bushfire99/papers/adams/

(Allen, 1979) Allen, D. 1979. *Wolves of Minong: Their vital role in a wild community*. Houghton Mifflin Company, Boston.

(Anon., 2001) Anonymous. 2001. "Research Resumes on Super-Size Brookies." *Michigan Tech News*. http://www.admin.mtu.edu/urel/breaking/2001/brookies.html .

(Anon., no date) Anonymous. No date. Chemicals to Fight Fires at the Wildland/Urban Interface.http://www.google.com/search?q=cache:VsOR3gqzKoUC:www.precision.rotor.com/trialpgs/chemicals.shtml+retardant++forest+fires&hl=en .

(Brandner, et al., 1990) Brandner, T.A., R.O. Peterson, and K.L. Rishenhoover. 1990. Balsam fir on Isle Royale: Effects of moose herbivory and population density. *Ecology* 71(1):155-164.

(Burt and Grossenheider, 1964) Burt, W. H. and R. P. Grossenheider. 1964. *A Field Guide to the Mammals*. Boston: Houghton Mifflin.

(California EPA, 1999) California Environmental Protection Agency, Air Resources Board. 1999. Fact Sheet – New Regulations for Gasoline Engines. Accessed on the World Wide Web at http://www.arb.ca.gov/msprog/marine/marine.htm .

(Clark, 1990) Clark, C. P. 1990. Archeological Survey and Testing at Isle Royale National Park. Midwest Archeological Center. Lincoln, NE.

(Cochrane, 1991) Cochrane, J.F. 1991. Feasibility study of the restoration of woodland caribou at Isle Royale National Park, Michigan. Resource management report 91-1. USDI National Park Service. Isle Royale National Park. Houghton, MI.

(Cole et al., 1995) Cole, K.L., M. G. Winkler, R. A. Flakne, and T. Cochrane. 1995. Preliminary report on the fire and vegetation history of Isle Royale. Isle Royale National Park Resource Management files, Houghton, MI.

(Cornman, 2001) Cornman, D.. 2001. "Effects of Noise on Wildlife." Nature Sounds Society. http://www.naturesounds.org/conservENW.html .

(Cowardin, et al., 1979) Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service.

(DOD, 1978) U. S Department of Defense. 1978. *Environmental Planning in the Noise Environment.*

(DuFresne, 1991) DuFresne, J. 1991. *Isle Royale National Park: Foot Trails & Water Routes.* Seattle: The Mountaineers.

(Egan, 2001) Egan, A. 2001. Isle Royale National Park Breeding Bird Survey Report.

(Eliason, 2002) Minnesota Department of Natural Resources, Natural Heritage and Nongame Research Program. Personal communication with Bonita Eliason, Supervisor. 14 January 2002.

(EMS, 2001) Environmental Media Services. 2001. Dioxin Fast Facts. Accessed on the World Wide Web at http://www.ems.org/dioxin/sub2_dioxin.html .

(Evers, et al., 1996) Evers, D.C., P.S. Reaman, J.D. Kaplan, and J.D. Paruk. 1996. North American loon biomonitoring program: 1995 Field Season Final Report. 1989-95 Comprehensive Report. Biodiversity, Inc.

(Fitzner, 2002) Michigan Department of Environmental Quality, Air Quality Division, Modeling and Meteorology. 2002. Personal communication with supervisor Craig Fitzner, May.

(Gleeson and Jones, 2000) Gleeson, P. and A. T. Jones. 2000. "Cultural Resource Protection and Federal Fire Management Issues." *Cultural Resource Management*. USDI National Park Service. No. 6.

(Gossman Consulting, no date) Gossman Consulting, Inc. No date. Dioxin (PCDD/PCDF) Emissions, Sources and Test Methods Polychlorinated dibenzo-dioxins (PCDDs) & Polychlorinated dibenzo-furans (PCDFs). Accessed on the World Wide Web at http://gcisolutions.com/soldioxin.htm .

(Gramann, 1999) Gramann, J. 1999. "The Effect of Mechanical Noise and Natural Sound on Visitor Experiences in Units of the National Park System." *Social Science Research Review*. USDOI National Park Service. Vol. 1, No. 1, Winter.

(Hamilton, et al., no date) Steve Hamilton, Diane Larson, Susan Finger, Barry Poulton, Nimish Vyas, and Elwood Hill. No date. Ecological effects of fire retardant chemicals and fire suppressant foams. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. Department of the Interior, U.S. Geological Survey. http://www.npwrc.usgs.gov/resource/othrdata/fireweb/fireweb.htm (Version 02MAR98).

(Health & Safety Executive, 2000). Health & Safety Executive. 2000. Noise. Accessed on the World Wide Web at http://www.hse.gov.uk/pubns/as8.pdf .

(Heinselman, 1996) Heinselman, M. 1996. *The Boundary Waters Wilderness Ecosystem*. Minneapolis: University of Minnesota Press.

(Huber, 1975) Huber, N.K. 1975. The geologic story of Isle Royale National Park. *Geological Survey Bulletin* 1309.

(Hunter, 1990). Hunter, M.L. Jr. 1990. *Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity*. Englewood Cliffs, NJ: Prentice Hall.

(HUD, 1991) U.S. Department of Housing and Urban Development. 1991. *The Noise Guidebook.*

(INCE, 1995) Institute of Noise Control Engineering. 1995. Glossary of Terms in Noise Control Engineering. *Noise/News International*. 3**,** 161-168, September.

(ISRO, 1992) Isle Royale National Park. 1992. *Fire Management Plan*.

(ISRO, 1999) Isle Royale National Park. 1999. *Resources Management Plan*.

(ISRO, 2000) Isle Royale National Park. 2000 Visitor Use Data Summary.

(ISRO, 2001) Isle Royale National Park. 2001. Visitor Use Data Summary.

(ISRO, 2002) Isle Royale National Park. 2002. GIS data provided by School of Forestry & Wood Products of Michigan Technological University in Houghton

(Janke et al., 1978) Janke, R.A., D. McKaig, R. Raymond. 1978. Comparison of pre-settlement and modern upland boreal forests on Isle Royale National Park. *Forest Science*. 24 (1): 115-121.

(Judziewicz, 1995a) Judziewicz, E. 1995. Final Report: Inventory and establishment of monitoring programs for special floristic elements at Isle Royale National Park, Michigan (Phase I). Isle Royale National Park.

(Judziewicz, 1995b) Judziewicz, E. 1995. Survey of non-native (exotic) vascular plant species of campgrounds, developed areas, and Passage Island Lighthouse and trail at Isle Royale National Park, Michigan. Resource Management Report 95-1. Isle Royale National Park, MI.

(Lazaroff, 2000) Lazaroff, C. 2000. Gray Wolf May Lope Off Endangered List. Environment News Service. 11 July 2000. http://ens.lycos.com/ens/jul2000/2000L-07-11-07.html .

(Linn, et al., 1966) Linn, R.M, L. Sumner, and G. Sprugel, Jr., eds. 1966. Isle Royale National Park natural science research plan. USDI National Park Service. Washington, DC.

(Little, 1978) Little, J.J. 1978. *Island Wilderness: A History of Isle Royale National Park*. Dissertation, University of Toledo.

(MacArthur and Wilson, 1967) MacArthur, R.H. and E.O. Wilson. 1967. *The Theory of Island Biogeography*. Princeton University Press. Monograph 1, Population Biology Series.

(Matzner, 2001) Matzner, P. 2001. "Quietude, Wilderness Values and Conservation." Nature Sounds Society. http://www.naturesounds.org/conservQWVC.html .

(MDNR, 1994) Michigan Department of Natural Resources. 1994. Michigan fish contaminant monitoring program: 1994 Annual Report.

(Michigan State University Extension, 1999a) Michigan State University Extension. 1999. Michigan's Special Animals: Endangered, Threatened, Special Concern, and Probably Extirpated. March.

(Michigan State University Extension, 1999b) Michigan State University Extension. 1999. Michigan's Special Plants: Endangered, Threatened, Special Concern, and Probably Extirpated. March.

(MNICS, 2001) Minnesota Incident Command System Prescribed Fire Working Team. 2001. Minnesota Smoke Management Plan (Draft).

(NAST, 2000) National Assessment Synthesis Team. *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. US Global Change Research Program. New York: Cambridge University Press.

(NIEHS, 2001) National Institute of Environmental Health Sciences. 2001. Dioxin Research at the National Institute of Environmental Health Sciences (NIEHS). Accessed on the World Wide Web at http://www.niehs.nih.gov/oc/factsheets/dioxin.htm .

(NIFC, 1998) National Interagency Fire Center. 1998. *Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide.*

(NPS, 1992) National Park Service. 1992. Environmental Assessment for the Fire Management Plan. Isle Royale National Park, Michigan. USDOI, NPS Midwest Region.

(NPS, 1997a) National Park Service. 1997. Raptor inventory at Isle Royale National Park, Michigan. Report 97-2.

(NPS, 1997b) National Park Service. 1997. Breeding bird survey at Isle Royale National Park, Michigan. RM 97-3.

(NPS, 1998) National Park Service. 1998. *Final General Management Plan / Environmental Impact Statement.* Isle Royale National Park, Michigan.

(NPS, 1999) National Park Service. 1999. Director's Order #41: Wilderness Preservation and Management. http://www.wilderness.net/nwps/policy/nps_dir_order_policy.cfm .

(NPS, 2000) National Park Service. 2000. *Management Policies 2001*.

(NPS, 2001) National Park Service. 2001. *Conservation Planning, Environmental Impact Analysis, and Decision Making*. Director's Order #12 and Handbook. 8 January.

(NYDEC, 2001) New York State Department of Environmental Conservation, Office of Environmental Permits. Revised 2 February 2001. Assessing and Mitigating Noise Impacts. Program Policy, DEP-00-3. Issuance Date 6 October 2000.

(Peterson, 1977) Peterson, R.O. 1977. *Wolf ecology and prey relationships on Isle Royale.* NPS Scientific monograph series no. 11. US Government Printing Office. Washington, DC.

(Peterson, 2003) Peterson, R.O. 2003. Personal communication with wolf biologist Rolf O. Peterson, Michigan Technological University, 3 March.

(Peterson and Vucetich, 2001) Peterson, R.O. and J.A. Vucetich. 2001. Ecological Studies of Wolves on Isle Royale: Annual Report 2000-2001. School of Forestry and Wood Products, Michigan Technological University, Houghton, MI.

(Radle, 1998) Radle, A.L. 1998. The Effect of Noise on Wildlife: A Literature Review. World Forum for Acoustical Ecology, University of Oregon, Eugene. Accessed on the World Wide Web at http://interact.uoregon.edu/MediaLit/wfae/readings/radle.html#2 .

(Rakestraw, 1965) Rakestraw, L. 1965. *Historic Mining on Isle Royale*. Isle Royale Natural History Association. Houghton, MI.

(Roeser, no date) Roeser, R.J. No date. Hearing and Noise: Hearing Conservation. Accessed on the World Wide Web at http://www.earspecialtygroup.com/dis_hearcons.html# .

(Romanski, 2000) Romanski, M. 2000. 2000 Raptor Inventory, Isle Royale National Park, Michigan. Resource Management Report 00-4, December.

(Rusterholz, 2002) Minnesota Department of Natural Resources, Natural Heritage and Nongame Research Program. Personal communication with K. Rusterholz, Forest Ecologist. 15 January 2002.

(SNF, 2001) Superior National Forest. 2001. *Final Environmental Impact Statement – Boundary Waters Canoe Area Wilderness Fuel Treatment*. USDA Forest Service.

(Shetron and Stottlemyer, 1991) Shetron, S.G. and R. Stottlemyer. 1991. Soil survey of Isle Royale National Park. Final report to the National Park Service. 238 pp. plus maps.

(Slavick and Janke, 1993) Slavick, A.D, and R.A. Janke. 1993. The vascular flora of Isle Royale National Park (3rd ed). Isle Royale Natural History Association.

(TPW, 1999) Texas Parks & Wildlife. 1999. Nature: Threatened and Endangered Species, Peregrine Falcon. http://www.tpwd.state.tx.us/nature/endang/birds/peregrin.htm .

(TRI, no date) Toxics Release Inventory. No date. Questions and Answers about Dioxin. Accessed on the World Wide Web at http://www.trifacts.org/q_and_a/q_and_a.php .

(Uhler, 2002) Uhler, J.W. 2002. Isle Royale National Park Information Page: Moose and Wolves. http://www.isle.royale.national-park.com/info.htm#moose .

(USDA Forest Service, 2000a) USDA Forest Service. 2000. Briefing Paper: Fire and Aviation Management. http://www.fs.fed.us/fire/aviation/retardant/Retardant_Briefing_Paper.htm .

(USDA Forest Service, 2000b) U.S. Department of Agriculture, Forest Service. 2000. "Agencies lift suspension of retardant products for wildland fires." *USFS Fire News*, April 20.

(USDA Forest Service, 2001) U.S. Department of Agriculture, US Forest Service. 6 June 2001. Wildland Fire Suppression Chemicals Toxicity and Environmental Issues and Concerns. Accessed June 2001. http://www.fs.fed.us/rm/fire/The_Environment.html

(USDA Forest Service, no date) U.S. Department of Agriculture, Forest Service. No date. Wildland Fire Suppression Chemicals Toxicity and Environmental Issues and Concerns. http://www.fs.fed.us/rm/fire/The_Environment.html

(USDA FSIS, 1999) U.S. Department of Agriculture, Food Safety and Inspection Service. 1999. Dioxin Advisories and Guidance, General Scientific Information. Accessed on the World Wide Web at http://www.fsis.usda.gov/OA/topics/dioxmenu.htm .

(USEPA, 1999) U.S. Environmental Protection Agency. 1999. Fact Sheet – Final Regional Haze Regulations for Protection of Visibility in National Parks and Wilderness Areas.

(USEPA, 2001) U.S. Environmental Protection Agency. 20001. List of 156 Mandatory Class I Federal Areas, Code of Federal Regulations (Reference 40 CFR Part 81). Available on the World Wide Web at http://www.epa.gov/oar/vis/class.html .

(USFWS, 1992) U.S. Fish and Wildlife Service. 1992. Recovery Plan for the Eastern Timber Wolf. Twin Cities, MN. 73 pp.

(USFWS, 1998) U.S. Fish and Wildlife Service. 1998. U.S. Fish and Wildlife Service Begins Coaster Brook Trout Egg Collection on Lake Superior. 28 September 1998 press release. http://darwin.eeb.uconn.edu/Documents/fws-980928-1.html .

(USFWS, 1999) U.S. Fish and Wildlife Service. 1999. Proposed Rule to Remove the Bald Eagle in the Lower 48 States From the List of Endangered and Threatened Wildlife. *Federal Register*. 64 FR 128: 36454-36464. July 6.

(USFWS, 2000) U.S. Fish and Wildlife Service. 2000. Proposal to Reclassify and Remove the Gray Wolf from the List of Endangered and Threatened Wildlife in Portions of the Conterminous United States; Proposal to Establish Three Special Regulations for Threatened Gray Wolves. *Federal Register*. 65 FR 135: 43450-43496. July 13.

(Valencia, 2001) U.S. Department of the Interior, National Park Service, Isle Royale National Park. Personal communication with forestry technician Pat Valencia. 16 October 2001.

(Vogl, 1979). Vogl, R.J. Some basic principles of grassland fire management. *Environmental Management* 3(1):51-57, 1979.

(Wright and Bailey, 1980). Wright, H.A. and A.W. Bailey. 1980. Fire ecology and prescribed burning in the Great Plains – A research review. United States Department of Agriculture, Forest Service, Intermountain Forest Range Experiment Station, Ogden, Utah. General Technical Report. INT-77.

(WDFW, 2002) Washington Department of Fish and Wildlife. 2002. "State's growing peregrine falcon population leads WDFW to consider status reclassification." 11 February 2002 News release, Washington Department of Fish and Wildlife, Olympia, WA.

(Wilson, 2002) Michigan Department of Natural Resources, Forest Management Division. Personal communication with Ronald Wilson, State Forest Fire Supervisor. 15 February 2002.

APPENDIX

APPENDIX A

ACRONYMS AND ABBREVIATIONS

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AA	Antiquities Act
ACHP	Advisory Council on Historic Preservation
ARPA	Archeological Resources Protection Act
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
BWCAW	Boundary Waters Canoe Area Wilderness
BOD	Biochemical Oxygen Demand
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CIF	City of International Falls
CFR	Code of Federal Regulations
CWA	Clean Water Act
DEA	Draft Environmental Assessment
DOD	Department of Defense
DOI	Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FMP	Fire Management Plan
FMU	Fire Management Unit
FMA	Fire Management Area
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
GMP	General Management Plan
HSA	Historic Sites Act
IC	Incident Commander
IMPROVE	Interagency Monitoring of Protected Visual Environments
MAB	Man and Biosphere Programme of UNESCO
MDNR	Michigan Department of Natural Resources
MDEQ	Michigan Department of Environmental Quality
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	Miles Per Hour
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAST	National Assessment Synthesis Team
NEPA	National Environmental Policy Act

NGO	Non-Governmental Organization
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWCG	National Wildfire Coordinating Group
PA	Programmatic Agreement
PBB	Prescribed Burn Boss
P.L.	Public Law
PM	Particulate Matter
PM_{10}	Particulate Matter smaller than 10 microns in diameter
$PM_{2.5}$	Particulate Matter smaller than 2.5 microns in diameter
POL	Petroleum, Oils, and Lubricants
RCRA	Resource Conservation and Recovery Act
RMP	Resources Management Plan
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMP	Smoke Management Plan
SPCC	Spill Prevention, Control, and Countermeasures
SWPPP	Storm Water Pollution Prevention Plan
TNC	The Nature Conservancy
TPW	Texas Parks & Wildlife
T&E	Threatened and Endangered
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USACE	United States Army Corps of Engineers
USC	United States Code
USCB	United States Census Bureau
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USFS	United States Forest Service
USNVC	United States National Vegetation Classification
USFWS	United States Fish and Wildlife Service
VERP	Visitor Experience and Resource Protection
VOC	Volatile Organic Compound
WDFW	Washington Department of Fish and Wildlife
WFIP	Wildland Fire Implementation Plan
WFSA	Widland Fire Situation Analysis
WFU	Wildland Fire Use (for resource benefit)
WMP	Wilderness Management Plan

APPENDIX B

GLOSSARY

GLOSSARY

Air Quality*:* The characteristics of the ambient air (all locations accessible to the general public) as indicated by concentrations of the six air pollutants for which national standards have been established, and by measurement of visibility in mandatory Federal Class I areas.

Alluvium: Material transported and deposited on land by flowing water, such as clay, silt, and sand.

Ambient Air: Any unconfined portion of the atmosphere; open air, surrounding air.

Ambient Air Quality Standards: Standards established on a State or Federal level that define the limits for airborne concentrations of designated "criteria" pollutants (e.g., nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter, ozone, lead) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

Appropriate Management Response: Specific actions taken in response to a wildland fire to implement protection and fire use objectives. This term is a new term that does not replace any previously used term.

Archeology: The scientific study, interpretation, and reconstruction of past human cultures from an anthropological perspective based on the investigation of surviving physical evidence of human activity and the reconstruction of related past environments.

Archeological Resources: Any material of human life or activities that is at least 100 years old, and that is of archaeological interest.

Attainment Area: An area considered to have air quality as good as or better than the National Ambient Air Quality Standards as defined in the Clean Air Act. An area may be an attainment area for one pollutant and a non-attainment area for others. Attainment areas are defined using pollutant limits set by USEPA.

Best Management Practice (BMP): A practice or combination of practices chosen as the most effective, economical, and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with State and local water quality goals. Selection of appropriate BMPs depends largely upon the conditions of the site, such as land use, topography, slope, water table elevation, and geology.

Burning Period: That part of each 24-hour period when fires spread most rapidly, typically from 10 AM until sundown.

Climax: A biotic community that is in equilibrium with existing environmental conditions and represents the terminal stage of an ecological succession.

Combustion: Burning. Many important pollutants, such as sulfur dioxide, nitrogen oxides, and particulates (PM-10) are combustion products, often products of the burning of fuels such as coal, oil, gas and wood

Coniferous: Cone-bearing tree. Examples are pines, firs, spruces, hemlocks, and cedars.

Class I Area: An area set aside under the Clean Air Act (CAA) to receive the most stringent protection from air quality degradation. Mandatory Class I Federal areas are: (1) international parks, (2) national wilderness areas which exceed 5,000 acres in size, (3) national memorial parks which exceed 5,000 acres in size, and (4) national parks which exceed 6,000 acres and were in existence prior to the 1977 CAA Amendments. The extent of a mandatory Class I Federal area includes subsequent changes in boundaries, such as park expansions.

Criteria air pollutants: A group of y common air pollutants regulated by EPA on the basis of criteria (information on health and/or environmental effects of pollution) and for which NAAQS have been established. In general, criteria air pollutants are widely distributed over the country. They are: particulate matter (PM), carbon monoxide(CO), sulfur dioxide(SO_2), ozone(0_3), and lead.

Crown Fire: Fire that burns in the crowns of trees and shrubs. Usually ignited by a surface fire. Crown fires are common in coniferous forests and chaparral-type shrublands.

Cultural Landscape: A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. There are four general kinds of cultural landscapes, not mutually exclusive: historic sites, historic designed landscape, historic vernacular landscape, and ethnographic landscape.

Cultural Resources: Any building, site, district, structure, object, data, or other material significant in history, architecture, archeology, or culture. Cultural resources include: historic properties as defined in the National Historic Preservation Act (NHPA), cultural items as defined in the Native American Graves Protection and Repatriation Act (NAGPRA), archeological resources as defined in the Archeological Resources Protection Act (ARPA), sacred sites as defined in Executive Order 13007, *Protection and Accommodation of Access To "Indian Sacred Sites,"* to which access is provided under the American Indian Religious Freedom Act (AIRFA), and collections.

Cumulative Impacts: Impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency (Federal or non-Federal) or person undertakes such other actions; effects resulting from individually minor, but collectively significant, actions taking place over a period of time.

Deciduous: Shedding leaves annually. Deciduous trees tend to be broad-leafed, such as oaks, maples, birches, and aspens. However, the larch, which is a needle-bearing, coniferous tree, is also deciduous.

Ecosystem: An interacting system of interdependent organisms.

Ecotone: Zone of transition from one ecosystem, plant community or habitat to another.

Endangered Species: A species of plant or animal that is in danger of extinction throughout all or a significant portion of its range.

Ethnography: Part of the discipline of cultural anthropology concerned with the systematic description and analysis of cultural systems or lifeways, such as hunting, agriculture, fishing, other food procurement strategies, family life festivals and other religious celebrations.

Federal Land Manager (FLM): With respect to any lands in the United States, the Secretary of the Federal department with authority over such lands. Generally, the Secretaries delegate their authority to specific elements within each department. For example, the National Park Service and the Fish and Wildlife Service manage those areas under the authority of the Department of the Interior.

Fire Exclusion: The policy of suppressing all wildland fires in an area (Smith 2000).

Fire Frequency = Fire Occurrence: Number of fires per unit time in a specified area (McPherson and others 1990).

Fire Intensity: A general term relating to the heat energy released in a fire. FEIS usually uses more specific terms to describe rate of heat release. See FIRELINE INTENSITY below.

Fire Interval: Time (in years) between two successive fires in a designated area (i.e., the interval between two successive fire occurrences); the size of the area must be clearly specified (McPherson and others 1990).

Fire Management Plan (FMP): A strategic plan that defines a program to manage wildland and prescribed fires, and documents the FMP to meet management objectives outlined in the approved resource management plan. The plan is supplemented by operational procedures such as preparedness plans, burn plans and prevention plans.

Fire Management Unit (FMU): Any land management area definable by objectives, topographic features, access, values-to-be-protected, political boundaries, fuel types, or major fire regimes, etc., that sets it apart from management characteristics of an adjacent unit. FMU's are delineated in FMP's. These units may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

Fire-Dependent Ecosystem: A community of plants and animals that must experience recurring disturbances by fire in order to sustain its natural plant succession, structure and composition of vegetation, and maintain appropriate fuel loading and nutrient cycling to ensure proper ecosystem function.

Fire Use: The combination of wildland fire use and prescribed fire application to meet resource objectives.

Fixed-Wing Aircraft: Floatplane or ski plane-configured aircraft.

Fuel: Fuel is comprised of living and dead vegetation that can be ignited. It is often classified as dead or alive and as natural fuels or activity fuels (resulting from human actions, usually from logging operations). Fuel components refer to such items as downed dead woody material by various size classes, litter, duff, herbaceous vegetation, and live foliage.

General Management Plan (GMP): A document that sets forth a basic management philosophy and a framework for decision-making for each unit of the National Park System, such as Isle Royale National Park, for a period of 15-20 years.

Geological Formation: Layers of rock, deposited in the same geological age and forming a distinctive unit.

Ground Fire: Fire that burns in the organic material below the litter layer, mostly by smoldering combustion. Fires in duff, peat, dead moss and lichens, and punky wood are typically ground fires (Brown 2000).

Groundwater: Water in the porous rocks and soils of the earth's crust; a large proportion of the total supply of fresh water.

Hardwoods: Broad-leaf trees that are usually deciduous and tend to have harder wood than conifers. Includes oaks, maples, hickories, ashes, birches, aspens, and poplars.

Hazard Fuel: A fuel complex that, by nature, presents a hazard to socio-politico-economic interests when ignited. The hazard fuel condition can be mitigated through hazard fuel reduction.

Hazardous fuels: Those vegetative fuels which, when ignited, threaten: public safety, structures and facilities, cultural resources, natural resources, and/or natural processes. Also: fuels that permit the spread of wildland fires across administrative boundaries except as authorized by agreement, and fuel accumulations and arrangement may be within the natural range of variability and still be hazardous because of the proximity to values at risk.

Hazardous Materials: Solid or liquid materials which may cause or contribute to mortality or serious illness by virtue of physical and chemical characteristics, or pose a hazard to human health or the environment when improperly managed, disposed of, treated, stored, or transported.

Hazardous Waste: A waste or combination of wastes which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Haze: An atmospheric aerosol of sufficient concentration to be visible. The particles are too small to see individually, but reduce visual range by scattering light.

Historic District: a geographically definable area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, landscapes, structures, or objects, united by past events or aesthetically by plan or physical developments.

Historic Property: As defined by the NHPA, a historic property or historic resource is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), including any artifacts, records, and remains that are related to and located in such properties. The term also includes properties of traditional religious and cultural importance (traditional cultural properties), which are eligible for inclusion in the NRHP as a result of their association with the cultural practices or beliefs of an Indian tribe or Native Hawaiian organization.

Interior Lakes: Bodies of water found on the main island of Isle Royale National Park.

Intermittent Stream: A stream that flows only at certain times of the year when it receives water from rainfall, surface runoff, or springs.

Interpretation: A communication process designed to reveal meanings and relationships of cultural and natural heritage to the public through first-hand experiences with objects, artifacts, landscapes or sites; facilitating a connection between the interests of the visitor and the meaning of the park by explaining the park's purpose and significance; usually a single contact with a group or individual.

Inversion*:* A layer in the atmosphere where the temperature increases with altitude.

Land Use Plan: A broad scale, long range plan (e.g., forest plan, refuge plan or resource management plan) that identifies the scope of actions and goals for the land and resources administered by a land owner/manager.

Ladder Fuels: Shrubs and young trees that provide continuous fine material from the forest floor into the crowns of dominant trees.

Litter: The top layer of the forest floor (01 soil horizon); includes freshly fallen leaves, needles, fine twigs, bark flakes, fruits, matted dead grass and other vegetative parts that are little altered by decomposition. Litter also accumulates beneath rangeland shrubs. Some surface feather moss and lichens are considered to be litter because their moisture response is similar to that of dead fine fuel.

Loam: A soil material which contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Loess: Geological deposits of fairly uniform, fine material, mostly silt, which is presumably transported by wind.

Mast: Fruits of all flowering plants used by wildlife, including fruits with fleshy exteriors (such as berries) and fruits with dry or hard exteriors (such as nuts and cones).

Mitigation: A method or action to reduce or eliminate adverse program impacts.

Mobile sources: Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers. Mobile sources are divided into two groups: road vehicles, which include cars, trucks and buses, and non-road vehicles that include trains, planes and lawn mowers.

Monitoring (monitor): Systematically observing, recording, or measuring some environmental attribute, such as air quality or water quality, or ascertaining compliance with a given law, regulation, or standard. For example, measurement of air pollution is referred to as monitoring. EPA, state and local agencies measure the types and amounts of pollutants in the ambient air. The 1990 Clean Air Act requires certain large polluters to perform enhanced monitoring to provide an accurate picture of how much pollution is being released into the air. The 1990 Clean Air Act requires states to monitor community air in polluted areas to check on whether the areas are being cleaned up according to schedules set out in the law.

Municipal: Belonging to a corporation or city.

National Environmental Policy Act (NEPA): Establishes procedures that Federal agencies must follow in making decisions on Federal actions that may impact the environment. Procedures include evaluation of environmental effects of proposed actions, and alternatives to proposed actions, involvement of the public and cooperating agencies.

National Ambient Air Quality Standards (NAAQS): Standards for maximum acceptable concentrations of "criteria" pollutants in the ambient air to protect public health with an adequate margin of safety (primary standard), and to protect public welfare from any known or anticipated adverse effects of such pollutants (e.g., visibility impairment, soiling, materials damage, etc.) in the ambient air (secondary standard).

National Fire Danger Rating System (NFDRS): A widely-used system to predict several measures of fire probability and resistance to control.

National Historic Landmark (NHL): A special type of historic property designated because of its national importance in American history, architecture, archaeology, engineering, or culture. Section 800.10 of the Advisory Council on Historic Preservation's regulations (36 CRF 800), as well as Section 110(f) of the National Historic Preservation Act, specify special protections for NHLs.

Natural Fire: Fires ignited by natural means (usually lighting).

Natural Resources: Phenomena that occur in their natural state - wildlife, fisheries, water, forests, air, soils, minerals, etc.

Nonattainment Area: A geographic area that has been designated by the U.S. Environmental Protection Agency and the appropriate state air quality agency as exceeding one or more National Ambient Air Quality Standards. It has been estimated that 60% of Americans live in nonattainment areas.

Nonpoint Source: A source of pollution that is inherently diffuse or dispersed, such as land runoff, precipitation, atmospheric deposition, or percolation.

Nuisance Smoke: Amounts of smoke in the ambient air that interfere with a right or privilege common to members of the public, including the use or enjoyment of public or private resources.

Organic Soils: Deep layers of organic matter that develop in poorly drained areas such as bogs, swamps, and marshes.

Ozone: A gas that is a variety of oxygen. Ozone consists of three oxygen atoms stuck together into an ozone molecule. Ozone occurs in nature; it produces the pungent odor smelled near a lightning strike. High concentrations of ozone occur in a layer of the atmosphere -- the stratosphere -- high above the Earth. Stratospheric ozone shields the Earth from harmful rays from the sun, particularly ultraviolet B. Smog's main component is ozone; this ground-level or tropospheric ozone is a product of reactions among chemicals produced by burning coal, gasoline and other fuels, and chemicals found in products including solvents, paints, hair sprays, etc.

Parent Material: Disintegrated and partly weathered rock from which soils are formed.

Particulate Matter (PM): A mixture of very small particles that are suspended in the atmosphere, except uncombined water, which exists as a solid or liquid at standard conditions (e.g., dust, smoke, mist, fumes, or smog).

PM_{10}: Particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (including $PM_{2.5}$). Concentrations in the air are measured as micrograms per cubic meter of air (ug/m3).

$PM_{2.5}$: Particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers. Concentrations in the air are measured as micrograms per cubic meter of air (ug/m3).

Perennial Stream: A stream that flows throughout the year.

Prescribed Fire: Any fire ignited by management actions to meet specific objectives (i.e., managed to achieve resource benefits).

Prescription: Measurable criteria that guide selection of appropriate management response and actions. Prescription criteria may include the meteorological conditions affecting the area under prescription, as well as factors related to the state of the area to be burned such as the fuel moisture condition and other physical parameters. Other criteria which may be considered

include safety, economic, public health, environmental, geographic, administrative, social or legal considerations, and ecological and land use objectives.

Preservation: The act or process of applying measures necessary to sustain the existing form, integrity and materials of a historic structure, landscape, or object; generally is ongoing in nature involving repairs rather than extensive replacement and new work.

Proposed Wilderness: land recommended for designation as wilderness by Congress, based on a wilderness study submitted by a park or region, but which has not been approved by the Department and subsequently transmitted to Congress by the President; managed so as to not diminish wilderness characteristics.

Regional Haze: Generally, concentrations of fine particles in the atmosphere extending hundreds of miles across a region and causing deteriorated visibility conditions; wide-spread visibility impairment, especially in mandatory Class I Federal areas where visibility is an important value.

Resource Management Plan (RMP): A document prepared for a given unit of the National Park System, such as Isle Royale National Park, that sets forth goals, issues and strategies for the management, conservation and protection of natural and cultural resources at that unit.

Runoff: Non-infiltrating water entering a stream or other conveyance channel during and shortly after a rainfall.

Scoping: Planning process that solicits people's and "stakeholders'" opinions on the value of a park, issues facing a park, and the future of a park. Also used in the NEPA process at the outset of preparing an EA or an EIS to help determine the scope of the study and the major issues that merit investigation and analysis.

Sensitive Populations: Those populations to whom smoke may present particular health risks

Sensitive Receptors: Locations where human population tend to concentrate and where smoke could impact the health of those population or significantly impact visibility that may be detrimental to either health or the enjoyment of scenic qualities of the landscape. These may be residential concentrations in the form of towns or cities, or locations where people tend gather in groups such as parks. Travel routes such as highways may be labeled as sensitive receptor sites where smoke can be a factor in potential motor vehicle accidents. Particular areas along highways or other locations may be more prone to being declared sensitive receptor sites because of topographic and microclimate features.

Sere (seral): A succession of plant communities leading to a particular plant association.

Silt: Fine sediment suspended in stagnant water or carried by moving water; it often accumulates on the bottom of streams and rivers.

Smoke Management Program: Establishes a basic framework of procedures and requirements for managing smoke from fires that are managed for resource benefits. The purposes of SMP's are to mitigate the nuisance and public safety hazards (e.g., on roadways and at airports) posed by smoke intrusions into populated areas; to prevent deterioration of air quality and NAAQS violations; and to address visibility impacts in mandatory Class I Federal areas in accordance with the regional haze rules.

Soil Association: A landscape, named for its major soil types, that has a distinctive proportional pattern of soils, generally consisting of one or more major soils and at least one minor soil type.

Soil Erosion: The removal and loss of soil by the action of water, ice, gravity, or wind.

Source: Any place or object from which pollutants are released. A source can be a power plant, factory, dry cleaning business, gas station or farm. Cars, trucks and other motor vehicles are sources, and consumer products and machines used in industry can be sources too. Sources that stay in one place are referred to as stationary sources; sources that move around, such as cars or planes, are called mobile sources.

Southern Transitional Boreal Forest: Mixed vegetation community areas of the park that lie between Great Lakes northern hardwood forests and conifer-dominated boreal forests to the north.

State Historic Preservation Officer (SHPO): The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as a liaison for purposes of implementing the NHPA.

State Implementation Plan (SIP): A detailed description of the programs a state will use to carry out its responsibilities under the *Clean Air Act*. State implementation plans are collections of the regulations and emission reduction measures used by a state to reduce air pollution in order to attain and maintain NAAQS or to meet other requirements of the Act. The Clean Air Act requires that EPA approve each state implementation plan. Members of the public are given opportunities to participate in review and approval of state implementation plans.

Stationary Source: A place or object from which *pollutants* are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, etc.

Succession: The gradual, somewhat predictable process of community change and replacement leading toward a climax community; the process of continuous colonization and extinction of populations at a particular site.

Suppression: A management action intended to protect identified values from a fire, extinguish a fire, or alter a fire's direction of spread.

Threatened Species: A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Violation of the PM NAAQS: As revised in 1997, the daily PM_{10} standard is violated when the 99th percentile of the distribution of 24-hour concentrations for a period of 1 year (averaged over 3 calendar years) exceeds 150 $\mu g/m^3$ at any monitor within an area. The annual PM_{10} standard is violated when the arithmetic average of 24-hour concentrations for a period of 1 year (averaged over 3 calendar years) exceeds 50 $\mu g/m^3$ at any monitor within an area. For PM2.5the daily standard is violated when the 98th percentile of the distribution of the 24-hour concentrations for a period of 1 year (averaged over 3 calendar years) exceeds 65 $\mu g/m^3$ at any monitor within an area. The annual standard is violated when the annual arithmetic mean of the 24-hour concentrations from a network of one or more population-oriented monitors (averaged over 3 calendar years) exceeds 15 $\mu g/m^3$.

Visit: One person visiting a site or area for recreation purposes for any period of time.

Visitor Destination: Point of interest in the park established for day use visitation.

Volatile Organic Compounds (VOC's): Any organic compound that participates in atmospheric photochemical reactions. Some compounds are specifically listed as exempt due to their having negligible photochemical reactivity. [See 40 CFR 51.100.] Photochemical reactions of VOC's with oxides of nitrogen and sulfur can produce O_3 and PM.

Wetlands: Areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil, including swamps, marshes, bogs, and other similar areas.

Wilderness: According to the Wilderness Act of 1964, "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." Furthermore, it "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable."

Wildfire: An unwanted wildland fire.

Wildland Fire: Any non-structural fire, other than prescribed fire, that occurs in a wildland. Note: Wildland fires include unwanted (wild) fires and naturally-ignited fires that are managed within a prescription to achieve resource benefits.

Wildland Fire Suppression: An appropriate management response to wildland fire that results in the curtailment of fire spread and eliminates all identified threats from the particular fire. All wildland fire suppression activities provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and/or the use of critical firefighting resources.

Wildland Fire Use: The management of naturally-ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas as outlined in fire management plans. Operational management is described in the Wildland Fire Implementation Plan (WFIP). Wildland fire use is not to be confused with "fire use," which is a broader term encompassing more than just wildland fires.

Wildland/Urban Interface: The line, area or zone where structures and other human development meet or intermingle with wildlands.

Wildland: An area where development is generally limited to infrequent roads, railroads, utility corridors, and widely-scattered structures. The land is not cultivated (i.e., the soil is disturbed less frequently than once in 10 years), is not fallow, and is not in the United States Department of Agriculture (USDA) Conservation Reserve Program. The land may be neglected altogether or managed for such purposes as wood or forage production, wildlife, recreation, wetlands or protective plant cover. It may be publicly or privately-owned.

APPENDIX C

ENVIRONMENTAL LAWS AND REGULATIONS

Relevant Laws and Regulations	Summary	Affected Resource(s)
National Environmental Policy Act (NEPA) (42 USC 4321-4370)	Requires Federal agencies to evaluate the environmental impacts of their actions and to integrate such evaluations into their decision-making processes.	All
Council on Environmental Quality (CEQ) Regulations	These regulations (40 CFR 1500-1508) implement NEPA and establish two different levels of environmental analysis: the environmental assessment (EA) and the environmental impact statement (EIS). An EA determines whether significant impacts may result from a proposed action. If significant impacts are identified, an EIS is required to provide the public with a detailed analysis of alternative actions, their impacts, and mitigation measures, if necessary.	All
Antiquities Act (AA) (16 USC 431 et seq.)	Authorizes the President to designate as national monuments any historic landmarks and historic and prehistoric sites, structures, and objects situated on Federal land. Establishes the requirement of a permit for the examination or excavation of such nationally important sites and establishes penalties for their destruction.	Cultural Resources
Archaeological Resources Protection Act (ARPA) (16 USC 470a et seq.)	Ensures the protection and preservation of archeological resources on Federal lands.	Cultural Resources
Clean Air Act (CAA) (42 USC 7401 et seq.)	Among its varied provisions, the CAA establishes standards for air quality in regard to the pollutants generated by internal combustion engines. These standards, known as the National Ambient Air Quality Standards (NAAQS), define the concentrations of these pollutants that are allowable in air to which the general public is exposed ("ambient air").	Air Quality
Clean Water Act (CWA) (33 USC 1251 et seq.)	Section 401, the state water quality certification process, gives states the authority to grant, deny, or condition the issuance of Federal permits that may result in a discharge to the waters of the United States based on compliance with water quality standards. Section 404 regulates the discharge of pollutants, including dredged or fill material, into navigable waters of the U.S. through a permit system jointly administered by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE). Nonpoint sources requirements control pesticide runoff, forestry operations, and parking lots/motor pools. Point sources require individual or group permits and must be monitored at the point at which they enter public waters, storm sewers, or natural waterways. Section 311 (j) requires facilities to prepare a Spill Prevention Control and Countermeasure Plan, containing minimum prevention facilities, restraints against drainage, an oil spill contingency plan, etc.	Water Resources, Biological Resources

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC 9601 et seq.)	Provided broad Federal authority to respond directly to releases of hazardous materials that may endanger public health or the environment. Established prohibitions and requirements pertaining to closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when a responsible party cannot be identified.	Hazardous Materials
Endangered Species Act (ESA) (16 USC 1531-1544)	Prohibits the harming of any species listed by the U. S. Fish and Wildlife Service (USFWS) as being either Threatened or Endangered. Harming such species includes not only directly injuring or killing them, but also disrupting the habitat on which they depend.	Biological Resources
Federal Land Policy and Management Act (43 USC et seq.)	Declares that all public lands will be retained in federal ownership unless it is determined that a use other than public will better serve the interests of the nation. Requires that all public land be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, and environmental aspects of the land. Requires that all public lands and their resources be inventoried periodically and systematically.	All
Historic Sites Act (HSA) (16 USC 461 et seq.)	Authorizes the establishment of national historic sites, the preservation of areas of national interest, and the designation and the preservation of national historic landmarks (NHLs). Provides procedures for designation, acquisition, administration, and protection of such sites.	All
Migratory Bird Treaty Act (16 USC 703 et seq.)	Restricts the taking, possession, transportation, sale, purchase, importation, and exportation of migratory birds through permits issued by the USFWS.	Biological Resources
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	Places standards on all hazardous air pollutants and governs such areas as organic liquids, asbestos, polyurethane foam, and wastewater. NESHAP is implemented under U.S. EPA jurisdiction.	Air Quality, Waste Management
National Historic Preservation Act (NHPA) (16 USC 470 et seq.)	Provides the framework for Federal review and protection of cultural resources, and ensures that they are considered during Federal project planning and execution. The implementing regulations for the Section 106 process (36 CFR Part 800) have been developed by the Advisory Council on Historic Preservation (ACHP). The Secretary of the Interior maintains a National Register of Historic Places (NRHP) and sets forth significance criteria for inclusion in the register. Cultural resources included in the NRHP, or determined eligible for inclusion, are considered “historic properties” for the purposes of consideration by Federal undertakings.	Cultural Resources

National Park Service Organic Act of 1916 (16 USC et seq.)	Established the National Park Service to manage national parks for the purposes of conserving the scenery, natural resources, historic objects, and wildlife within the parks, and providing for the enjoyment these resources in such manner that will leave them unimpaired for the enjoyment of future generations.	All
Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq.)	Protects Native American human remains, burials, and associated burial goods.	Cultural Resources
Resource Conservation and Recovery Act (RCRA) (42 USC 6901 et seq.)	Regulates all aspects of the handling of hazardous waste through RCRA permits issued by the U.S. EPA.	Hazardous Materials
Safe Drinking Water Act (SDWA) (42 USC 300 et seq.)	Provides for the safety of drinking water throughout the U.S. by establishing and enforcing national drinking water quality standards. Protects public health by establishing safe limits (maximum containment limits) for contaminants based upon the quality of water at the tap, and prevents contamination of surface and ground sources of drinking water. The U.S. EPA is responsible for establishing the national standards; the States are responsible for enforcement of the standards.	Water Resources/ Quality; Human Health & Safety
Wilderness Act of 1964 (16 USC 1121 (note), 1131-1136)	Establishes the National Wilderness Preservation System. Wilderness defined as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain…which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable."	Wilderness
Executive Order 11514: Protection and Enhancement of Environmental Quality	Provides leadership for protecting and enhancing the quality of the Nation's environment to sustain and enrich human life.	All
Executive Order 11593: Protection and Enhancement of the Cultural Environment	Provides leadership for protecting, enhancing, and maintaining the quality of the Nation's historic and cultural environment.	Cultural Resources
Executive Order 12372: Intergovernmental Review of Federal Programs	Directs Federal agencies to consult with and solicit comments from state and local government officials whose jurisdictions would be affected by Federal actions.	All
Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Requires Federal actions to achieve Environmental Justice by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.	All

Executive Order 13007: Protection and Accommodation of Access To "Indian Sacred Sites"	Directs Federal agencies to consider Indian sacred sites in planning agency activities.	Cultural Resources
Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks	Requires Federal actions and policies to identify and address disproportionately adverse risks to the health and safety of children.	All
Executive Order 11990: Protection of Wetlands	An overall wetlands policy for all agencies managing Federal lands, sponsoring Federal projects, or providing Federal funds to State or local projects. It requires Federal agencies to follow avoidance/mitigation/ preservation procedures with public input before proposing new construction projects.	Water Resources, Biological Resources
Executive Order 11988: Floodplain Management	Requires all Federal agencies to take action to reduce the risk of flood loss, to restore and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare. Because many wetlands are located in floodplains, Executive Order 11988 has the secondary effect of protecting wetlands.	Water Resources, Biological Resources
Executive Order 12856: Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements	Requires that the head of each federal agency be responsible for ensuring that all necessary actions are taken for the prevention of pollution with respect to the agency's activities and facilities, and for ensuring that the agency complies with pollution prevention, emergency planning, and community right-to-know provisions.	Hazardous Materials

APPENDIX D

SCOPING

1. Scoping News Release
2. EA scoping mailing list

NEWS RELEASE u.s. department of the interior

national park service

For Immediate Release Jack Oelfke (906)487-9080

ISLE ROYALE NATIONAL PARK UPDATING WILDLAND FIRE MANAGEMENT PLAN

(Houghton, Michigan) - Isle Royale National Park has begun the process of updating the park's Wildland Fire Management Plan, which was approved in September of 1992. National Park Service (NPS) policy requires periodic updates of fire management plans. This updating process and associated analysis will explore the various ways in which NPS and park fire management policy can be carried out and will analyze the impacts associated with a variety of fire management programs.

"We are requesting comments on various ways to manage the fire management program. Since we are in the scoping stage of the project, our staff is trying to identify issues that need to be addressed," said Acting Superintendent Betsy Rossini. Issues include concerns regarding natural and cultural resources as well as socio-economic impacts. Once all the issues are identified, the appropriate level of compliance required under the National Environmental Policy Act and National Historic Preservation Act will be determined.

Fire has long played a natural role on the Isle Royale landscape, both in pre-historic and historic times. The management of fire in the park has undergone changes as the knowledge and awareness of the role of fire changed throughout the 20th century. A policy of total fire suppression evolved into one where certain lightning-ignited fires were allowed to largely run their course. Fires that have threatened structures or critical resources have been aggressively controlled. Significant changes have occurred on Isle Royale that has likely disrupted the pre-settlement fire cycle. For example, the effect of moose browsing since the early 1900s has reduced the flammability of the island's forests. Current research efforts are evaluating the long-term effects of continued browsing on the forest stands within the park, as well as the role that fire plays on these forest stands.

(more)

ISLE ROYALE NATIONAL PARK • HOUGHTON, MICHIGAN 49931

According to Rossini, "A policy of total, aggressive, strict fire control is not cost-effective, responsive to land management objectives, and most importantly, runs counter to the natural role of fire in biotic and abiotic systems. Knowledge of the natural role of fire in plant community dynamics and fire effects on individual species is continually expanding. It is now known that fire is an important natural process. In fact, many plant communities are dependent upon fire for their continued existence."

The park's current Wildland Fire Management Plan provides specific guidance and procedures for accomplishing park fire management objectives. Rossini said, "The NPS mission is to protect and preserve the lands it manages for the enjoyment of future generations. Guided by this mandate, the Service's fire management program focuses on restoring and maintaining natural processes associated with fire, while protecting human life and property." The updated plan will be the primary guide for all wildland fire management actions at Isle Royale, including response to wildland fire (lightning and human caused fires) and the possible use of prescribed fires.

The Wildland Fire Management Plan is in the initial scoping stage. Isle Royale National Park is requesting comments on issues that need to be addressed and various ways to manage the park's fire program. Interested parties can also request to be placed on a mailing list to receive notice of further actions in the planning process, including reviewing the Draft Wildland Fire Management Plan. Written comments should be postmarked no later than January 18, 2002 and be addressed to Superintendent, Isle Royale National Park, 800 East Lakeshore Drive, Houghton, MI 49931. Written comments may also be submitted via the Internet to: Jack_Oelfke@nps.gov.

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APPENDIX E

LISTED SPECIES OF FLORA AND FAUNA AT ISLE ROYALE NATIONAL PARK

STATE-LISTED PLANT SPECIES OF ISLE ROYALE NATIONAL PARK

COMMON NAME	SCIENTIFIC NAME	RANK[1]		1999 STATUS[1]			
		GLOBAL	STATE	US	MI	ABUNDANCE	HABITAT(S)
Wild chives	*Allium schoenoprasum*	G5	S2		T	uncommon	rock shore
Round-leaved orchid*	*Amerorchis rotundifolia*	G5	S1		E	rare	cedar swamps
***	*Antennaria microphylla*						
Rosy pussytoes*	*Antennaria rosea*	G4G5	SH		T	rare	"Caribou Is."
Big leaf sandwort	*Arenaria macrophylla*	G4	S1		T	rare	mixed woods
Dragon's mouth, Arethusa**	*Arethusa bulbosa*				SC	rare	bogs
Great northern aster	*Aster modestus*	G5	S1		T	rare	grassy, "Windigo"
Slough grass	*Beckmannia syzigachne*	G5	S1S2		T	rare	gravel shore, introduced?
Low northern rock-cress	*Braya humilis*	G4	S1		T		
Reedgrass	*Calamagrostis lacustris*	G3Q	S1		T	rare	rock opening
****	*Calamagrostis stricta*	G5	S1		T		
Autumnal water starwart	*Callitriche hermaphroditica*	G5	S2		SC	rare	aquatic
Calypso orchid	*Calypso bulbosa*	G5	S2		T	uncommon	boreal forest
Sedge	*Carex atratiformis*	G5	S2		T	uncommon	rock shore, beaches
Sedge*	*Carex media*	G5	S2S3		T	frequent	rock shore
Sedge***	*Carex norvegica*						
Eastern paintbrush	*Castilleja septentrionalis*	G5	S2S3		T	common	aspen woods, rock openings
Purple clematis	*Clematis occidentalis*	G5	S3		SC	uncommon	dry woods
Small blue-eyed mary	*Collinsia parviflora*	G5	S2		T	rare	rock ridges
Douglas's hawthorn	*Crataegus douglasii*	G5	S3S4		SC	rare	rock openings
Ram's head lady-slipper	*Cypripedium arietinum*	G3	S3		SC	rare	boreal forest
American rock brake*	*Cryptogramma acrostichoides*	G5	S2		E	uncommon	rock shores & ridges
American rock brake***	*Cryptogramma crispa*						
Slender rock brake	*Cryptogramma stelleri*	G5	S3S4		SC	rare	rock openings (conglomerate)
Rock whitlow-grass	*Draba arabisans*	G4	S3		SC	uncommon	rock shore & openings, island

[1] Source: Michigan State University, Michigan Natural Features Inventory. Michigan's Special Plants: Endangered, Threatened, Special Concern and Probably Extirpated. March 1999.

STATE-LISTED PLANT SPECIES OF ISLE ROYALE NATIONAL PARK (CONT.)

COMMON NAME	SCIENTIFIC NAME	RANK[1]		1999 STATUS[1]			
		GLOBAL	STATE	US	MI	ABUNDANCE	HABITAT(S)
Smooth whitlow-grass	*Draba glabella*	G4G5	S1		E	rare	rock shore, "Passage Is."
Twisted whitlow-grass	*Draba incana*	G5	S1		T	rare	rock shore, "Passage Is."
English sundew	*Drosera anglica*	G5	S3		SC	rare	bogs, rock shore pools
Fragrant cliff woodfern****	*Dryopteris fragrans*	G3	S3		SC		
Black crowberry	*Empetrum nigrum*	G5	S2		T	rare	rock shore
Moor rush****	*Juncus stygius*	G5	S1S2		T		
Blue lettuce	*Lactuca pulchella*	G5	SH		T	rare	openings, recent burns
Auricled twayblade	*Listera auriculata*	G3	S2S3		SC	rare	boreal forest
Involucred honeysuckle	*Lonicera involucrata*	G4G5	S2		T	rare	trails, "Mott, RH Lodge"
Small-flowered wood-rush	*Luzula parviflora*	G5	S1		T	uncommon	
Water-milfoil	*Myriophyllum alterniflorum*	G5	S2S3		SC	uncommon	aquatic (inland lks.)
Pygmy water-lily	*Nymphaea tertagona*	G5	S1		E	rare	stream deltas
Devil's club	*Oplopanax horridus*	G4G5	S2		T	uncommon	swamps, rock openings
Sweet Cicely	*Osmorhiza depauperata*	G5	S2		T	frequent	mixed woods
Marsh grass-of-parnassus	*Parnassia palustris*	G5	S2		T	rare	swamps, lake shores
Franklin's phacelia	*Phacelia franklinii*	G5	S1		T	uncommon	rock openings, "Crystal Cove, Captain Kidd"
Butterwort	*Pinguicula vulgaris*	G5	S3		SC	uncommon	rock shore, mossy banks
Alpine bluegrass	*Poa alpina*	G5	S1S2		T	rare	rock shore
Canby's bluegrass	*Poa canbyi*	G4G5	S1		E	rare	"Monument Rock"
Alpine buckwheat	*Polygonum viviparum*	G5	S1S2		T	uncommon	rock shore, beaches
Prairie cinquefoil	*Potentilla pensylvanica*	G5	S1		T	uncommon	rock shore
Macoun's buttercup	*Ranunculus macounii*	G5	S1		T	rare	swamp forests
Prairie buttercup	*Ranunculus rhomboideus*	G4	S2		T	uncommon	rock ridges
Gooseberry	*Ribes oxyacanthoides*	G5	S3		SC	frequent	clearings, beaches
Pearlwort	*Sagina nodosa*	G5	S2		T	uncommon	rock crevices
Satiny willow	*Salix pellita*	G5	S2		SC	rare	rock shore

STATE-LISTED PLANT SPECIES OF ISLE ROYALE NATIONAL PARK (CONT.)

COMMON NAME	SCIENTIFIC NAME	RANK		1999 STATUS			
		GLOBAL	STATE	US	MI	ABUNDANCE	HABITAT(S)
Tea-leaved willow	*Salix planifolia*	G5	SH		T	uncommon	rock shore, islands
***	*Salix pyrifolia*		SC				
Encrusted saxifrage	*Saxifraga paniculata*	G5	S1		T	rare	rock shore
Prickly saxifrage	*Saxifraga tricuspidata*	G4G5	S2		T	uncommon	rock shore
Rayless mountain ragwort	*Senecio indecorus*	G5	S1		T	uncommon	rock openings
Awlwort	*Sublaria aquatica*	G5	S1		E	rare	aquatic
False Asphodel	*Tofieldia pusilla*	G5	S2		T	uncommon	rock shore pools
Downy oatgrass	*Trisetum spicatum*	G5	S2S3		SC	frequent	rock shore
Dwarf bilberry*	*Vaccinium cespitosum*	G5	S1S2		T	absent?	
Alpine blueberry	*Vaccinium uliginosum*	G5	S2		T	rare	rock shore
Mountain-cranberry	*Vaccinium vitis-idaea*	G5	SX		X	extirpated	
Squashberry	*Viburnum edule*	G5	S2S3		T	common	boreal, mixed forests

* Species on rare plant list and state list but not on Slavick and Janke (1993) list.
** Listed by Slavick and Janke (1993) and rare plants list but not on state list.
*** Species listed by Slavick and Janke (1993) but not on state list or rare plant list.
**** Species listed by Slavick and Janke (1993) and state list. Not on rare plant list.

STATE-LISTED FISH SPECIES OF ISLE ROYALE NATIONAL PARK

COMMON NAME	SCIENTIFIC NAME	RANK[2]		1999 STATUS[2]			
		GLOBAL	STATE	US	MI	ABUNDANCE	HABITAT(S)
Lake Sturgeon	*Acipenser fulvescens*	G3	S2		T		Lake Superior
Cisco or Lake Herring*	*Coregonus artedii*	G5	S3		T		Lake Desor
Siskiwit Lake cisco**	*Coregonus bartletti*	G1Q	S1		SC		Siskiwit
Kiyi	*Coregonus kiyi*	G3	S3		SC		Lake Superior
Shortjaw cisco	*Coregonus zenithicus*	G2	S2		T		Lake Superior
Spoonhead sculpin	*Cottus ricei*	G5	S3		SC		Superior, Siskiwit, Chickenbone, Whittlesey

*Subspecies
**Species

Fish list taken from "Wildlife of Isle Royale" revised by Dr. Peter Jordon 1981.

STATE-LISTED MAMMAL SPECIES OF ISLE ROYALE NATIONAL PARK

COMMON NAME	SCIENTIFIC NAME	RANK		1999 STATUS			
		GLOBAL	STATE	US	MI	ABUNDANCE	HABITAT(S)
Moose	*Alces alces*	G5	S4		SC		
Gray Wolf	*Canis lupus*	G4	S3	LE	E		

Mammal list taken from "Wildlife of Isle Royale" revised by Dr. Peter Jordon 1981.

[2] *Source*: Michigan State University, Michigan Natural Features Inventory. Michigan's Special Animals: Endangered, Threatened, Special Concern and Probably Extirpated. March 1999.

STATE-LISTED BIRD SPECIES OF ISLE ROYALE NATIONAL PARK

COMMON NAME	SCIENTIFIC NAME	RANK[2]		1999 STATUS[2]			
		GLOBAL	STATE	US	MI	ABUNDANCE	HABITAT(S)
Cooper's hawk	*Accipiter cooperi*	G5	S3S4		SC	O,T	
Northern goshawk	*Accipiter gentilis*	G5	S3		SC	R	
Short-eared owl	*Asio flammeus*	G5	S1		E	A,T	
Long-eared owl	*Asio otus*	G5	S2		T	A,T	
American bittern	*Botaurus lentiginosus*	G4	S3S4		SC	R	
Red-shouldered hawk	*Buteo lineatus*	G5	S3S4		T	A	
Piping plover	*Charadrius melodus*	G3	S1	LE	E	H	
Black tern	*Chlidonias niger*	G4	S3		SC	A	
Lark sparrow	*Chondestes grammacus*	G5	SX		X	A	
Northern harrier	*Circus cyaneus*	G5	S3		SC	O,T	
Yellow rail	*Coturnicops noveboracensis*	G4	S1S2		T	H	
Merlin	*Falco columbarius*	G5	S1S2		T	R	
Peregrine felcon	*Falco peregrinus*	G4	S1		E	A,T	
Common loon	*Gavia immer*	G5	S3S4		T	R	
Bald eagle	*Haliaeetus leucocephalus*	G4	S4	LT	T	O	
Black-crowned night-heron	*Nycticorax nyticorax*	G5	S2S3		SC	A	
Osprey	*Pandion haliaetus*	G5	S4		T	O	
Black-backed woodpecker	*Picoides arcticus*	G5	S2		SC	R	
Dickcessel	*Spiza americana*	G5	S3		SC	A	
Caspian tern	*Sterna caspia*	G5	S2		T	A	
Common tern	*Sterna hirundo*	G5	S2		T	O	
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	G5	S2		SC	A	

Legend for Birds List:

R = regular occurence
O = occasional occurence
A = accidental occurence
H = hypothetical occurence
T = breeds on adjacent mainland

Species list and abundance based on "Wildlife of Isle Royale," revised 1981 by Dr. Peter Jordon.

No listed amphibians or reptiles are known to inhabit Isle Royale. In 1977 there was one inconclusive photo taken of what may have been a Black rat snake (Elaphe obsoleta obsoleta) which is listed as Special Concern in Michigan.

No comprehensive inventories of insects, snails, or mussels have ever been done for Isle Royale.

LEGEND FOR ALL LISTS

MI 1999 Current species status under the Michigan Endangered Species Act reviewed during 1996-98. Endangered and Threatened designations are legally effective as of March 20, 1999.

U.S. 1998 Species status under the Federal Endangered Species Act as of January 26, 1998. LE, LT (Listed Endangered, Listed Threatened) = Species has been officially listed as either Endangered (E), or Threatened (T). P (Proposed) = Species has been officially proposed for listing.

( ) Common synonyms of species names accepted by the State Technical Committee.

GLOBAL RANKS

G1 = critically imperiled globally because of extreme rarity (5 or fewer occurrences range-wide or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. a single western state, a physiographic region in the East) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = of historical occurrence throughout its range, i.e. formerly part of the established biota, with the expectation that it may be rediscovered (e.g. Bachman's Warbler).

GU = possibly in peril range-wide, but status uncertain; need more information.

GX = believed to be extinct throughout its range (e.g. Passenger Pigeon) with virtually no likelihood that itwill be rediscovered.

STATE RANKS

S1 = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.

S2 = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = rare or uncommon in state (on the order of 21 to 100 occurrences).

S4 = apparently secure in state, with many occurrences.

S5 = demonstrably secure in state and essentially ineradicable under present conditions.

SA = accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range.

SE = an exotic established in the state; may be native elsewhere in North America (e.g. house finch or catalpa in eastern states).

SH = of historical occurrence in state and suspected to be still extant.

SN = regularly occurring, usually migratory and typically nonbreeding species.

SR = reported from state, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.

SRF = reported falsely (in error) from state but this error persisting in the literature.

SU = possibly in peril in state, but status uncertain; need more information.

SX = apparently extirpated from state.

APPENDIX F

SECTION 7 CONSULTATION AND SECTION 106 COMPLIANCE

Section 107 Consultation (1973 Endangered Species Act)

The East Lansing Field Office of the U.S. Fish and Wildlife Service was sent a copy of the Preliminary Draft Environmental Assessment (for internal agency review) on Isle Royale National Park's Draft Fire Management Plan in November 2002. In their response, the USFWS field office concurred with NPS's statement that the endangered gray wolf and the threatened bald eagle are the only federally listed species found in the park. The field office also raised questions about designated critical habitat on Isle Royale for the wolf and the need for appropriate mitigation measures to protect eagle nests and wolf dens in the event of wildland and prescribed fires. These issues have been addressed in the Draft Environmental Assessment for public review.

In addition, the USFWS pointed out that both the gray wolf and the bald eagle may be "delisted" while the FMP is in effect, which would no longer accord them the statutory protection of the federal Endangered Species Act. Given their history, the USFWS recommended that both species continue to receive protective mitigation measures.

Section 106 Compliance (National Historic Preservation Act)

The Michigan State Historic Preservation Office (SHPO) was sent a copy of the Preliminary Draft Environmental Assessment (for internal agency review) on Isle Royale National Park's Draft Fire Management Plan in November 2002.

In early 2003, Isle Royale Cultural Resource Specialist Liz Valencia sent an email to Brian Grinnell at the Michigan SHPO. Mr. Grinnell called Ms. Valencia on February 13, 2003 and said that the SHPO did not respond to the draft Fire Management Plan/EA because they had no comments.